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Final Report  
September 1989

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TRANSPORTABILITY TESTING  
OF THE  
ARMY TACTICAL MISSILE SYSTEM  
(ATACMS)

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CHEMICAL COMMAND

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CENTER AND SCHOOL

EVALUATION DIVISION  
SAVANNA, ILLINOIS 61074-9639



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FIELD	GROUP	SUB-GROUP													
19. ABSTRACT (Continue on reverse if necessary and identify by block number)  The U.S. Army Defense Ammunition Center and School (USADACS), Evaluation Division (SMCAC-DEV), has been tasked by the U.S. Army Missile Command (MICOM), AMCPM-AT-T, Redstone Arsenal, AL to test the Army Tactical Missile System (ATACMS) in various shipping configurations and modes. Shipping configurations consisted of: six equivalent mass missiles blocked and braced in a boxcar; four mass equivalent missiles in a Military Van (MILVAN) secured to a load and roll pallet (LRP) with commercial web straps; four inert missiles secured to a flatrack with metal strap; and four secured to a military M871 semitrailer with nuclear straps. Containerized modes of transportation were subjected to rail, road, and Shipboard Transportation Simulator (STS) tests. Accelerometer data was recorded for all rail impact tests, the road hazard course, and the washboard course.															
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U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL  
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Savanna, IL 61074-9639

REPORT NO. EVT 37-88  
TRANSPORTABILITY TESTING OF THE  
ARMY TACTICAL MISSILE SYSTEM (ATACMS)

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PART 1

INTRODUCTION

A. BACKGROUND. The U.S. Army Defense Ammunition Center and School (USADACS), Evaluation Division (SMCAC-DEV), has been tasked by the U.S. Army Missile Command (MICOM), AMCPM-AT-T, Redstone Arsenal, AL to test the Army Tactical Missile System (ATACMS) in various shipping configurations and modes. Shipping configurations consisted of: six equivalent mass missiles blocked and braced in a boxcar; four mass equivalent missiles in a Military Van (MILVAN) secured to a load and roll pallet (LRP) with commercial web straps; four inert missiles secured to a flatrack with metal strap; and four secured to a military M871 semitrailer with nuclear straps. Containerized modes of transportation were subjected to rail, road, and Shipboard Transportation Simulator (STS) tests. Accelerometer data was recorded for all rail impact tests, the road hazard course, and the washboard course.

B. AUTHORITY. This test was conducted in accordance with mission responsibilities delegated by the U.S. Army Armament, Munitions and Chemical Command (AMCCOM), Rock Island, IL 61299-6000. Reference is made to Change 4, 4 October 1974, to AR-740-1, 23 April 1971, Storage and Supply Operations; AMCCOM-R 10-17, 13 January 1986, Mission and Major Functions of USADACS.

C. OBJECTIVE. The objective of these tests was to determine if the outloading procedures developed for the ATACMS provided suitable protection in a road, rail, and ship transportation environment. The tests performed on different ATACMS shipping configurations were: Rail Impact Test, Road Hazard Course, Road Trip, and Washboard Course.

D. CONCLUSIONS. All test configurations (boxcar, MILVAN, flatrack, and M871 semitrailer) passed the rail, road (hazard, trip, and washboard), and STS tests.

E. RECOMMENDATIONS. It is recommended that all outloading procedures be adopted for shipping ATACMS as follows: in a boxcar; LRP stowed inside a MILVAN for transportation on Trailer-on-flatcar (TOFC), semitrailer and ship; on a flatrack for transportation on TOFC, semitrailer and ship; and on an M871 tactical trailer secured with web straps. The outloading test procedures contained in this report were used for testing purposes and are not the final approved outloading procedures. They are not to be used for outloading.

PART 2

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### PART 3

#### TEST PROCEDURES

A. RAIL IMPACT TEST. The test load or vehicle should be positioned in/on a railcar. For containers, the loaded container shall be positioned on a container chassis and securely locked in place using the twist locks at each corner. The container chassis shall be secured to a railcar. Equipment needed to perform the test includes the specimen (hammer) car, five empty railroad cars connected together to serve as the anvil, and a railroad locomotive. These anvil cars are positioned on a level section of track with air and hand brakes set and with the draft gear compressed. The locomotive unit pulls the specimen car several hundred yards away from the anvil cars, then pushes the specimen car toward the anvil at a predetermined speed, disconnects from the specimen car about 50 yards away from the anvil cars, and allows the specimen car to roll freely along the track until it strikes the anvil. This constitutes an impact. Impacting is accomplished at speeds of 4, 6, and 8 miles per hour (mph) in one direction and at a speed of 8 mph in the opposite direction. The 4 and 6 mph impact speeds are approximate; the 8 mph speed is a minimum. Impact speeds are to be determined by using an electronic counter to measure the time required for the specimen car to traverse an 11-foot distance immediately prior to contact with the anvil cars.

B. HAZARD COURSE. The specimen being tested will be subjected to the road hazard course. Using a suitable truck/tractor or tactical vehicle, the vehicle/specimen of test method No. 1 shall be towed/driven over a hazard course two times at a speed of approximately 5 mph. The speed may be increased or decreased, as appropriate, to produce the most violent load response.

C. ROAD TRIP. Using a suitable truck/tractor and trailer, or tactical

vehicle, the tactical vehicle/specimen load shall be driven/towed for a total distance of at least 30 miles over a combination of roads surfaced with gravel, concrete, and asphalt. Test route shall include curves, corners, railroad crossings, cattle guards, stops, and starts. The test vehicle shall travel at the maximum speed suitable for the particular road being traversed, except as limited by legal restrictions. This step provides for the tactical vehicle/specimen load to be subjected to three full airbrake stops while traveling in the forward direction and one in the reverse direction while traveling down a 7 percent grade. The first three stops are at 5, 10, and 15 mph, while the stop in the reverse direction is of approximately 5 mph.

D. WASHBOARD COURSE. Using a suitable truck/tractor, and/or tactical vehicle, the specimen shall be driven/towed over the washboard course at a speed which produces the most violent response in the particular test load (as indicated by the resonant frequency of the suspension system beneath the load).

E. SHIPBOARD TRANSPORTATION SIMULATOR. The test load (specimen) shall be positioned on the STS and securely locked in place using the cam lock at each corner. Using the procedure detailed in the operating instruction, the STS shall be started oscillating at an amplitude of 30 degrees plus or minus 2 degrees, either side of center and a frequency of 2 cycles-per-minute (30 seconds plus 2 seconds total roll period). This frequency shall be observed for apparent defects that could cause a safety hazard. The frequency of oscillation shall then be increased to 4 cycles-per-minute (15 seconds plus 1 second roll period), and the apparatus operated for two hours. If an inspection of the load does not indicate an impending failure, the frequency of oscillation shall be further increased to 5 cycles-per-minute (12 second plus 1 second cycle time), and the apparatus operated for four hours. The operation does not necessarily have to be continuous; however, no

change or adjustments to the load or load restraints shall be permitted at any time during the test. After once being set in place, the test load (specimen) shall not be removed from the apparatus until the test has been completed or is terminated.

**PART 4**  
**TEST RESULTS**

RAIL IMPACT TEST

TEST NO. 1

DATE: 30 MAY 1989

TEST SPECIMEN: ATACMS in a boxcar with 12 channels of instrumentation.

TEST CAR NO: RBOX 40247

LT. WT. 63,100 POUNDS

LADING AND DUNNAGE

WT. 32,000 POUNDS

TOTAL SPECIMEN

WT. 95,100 POUNDS

BUFFER CAR (5 CARS)

WT. 250,000 POUNDS

IMPACT NO.	END STRUCK	VELOCITY (MPH)	REMARKS
------------	------------	----------------	---------

1	Forward	3.96	Impact end moved 3/16 inch. Middle rack moved 3/4 inch. Far end moved 1 inch.
---	---------	------	---

2	Forward	6.45	Impact end moved 9/16 inch which broke the 2 x 6 vertical support at the end of the rubber skid. Center pods moved 2-5/8 inches and completely broke off the 2 x 6 vertical supports on the impact end of the center pods. Rear end of load shifted 2-5/8 inch. LOAD FAILED.
---	---------	------	--

## RAIL IMPACT TEST

TEST NO. 2

DATE: 31 May 1989

TEST SPECIMEN: ATACMS in a boxcar with 12 channels of instrumentation and with doubled 2 x 6 vertical supports.

TEST CAR NO: RBOX 40247

LT. WT. 63,100 POUNDS

LADING AND DUNNAGE

WT. 32,000 POUNDS

TOTAL SPECIMEN

WT. 95,100 POUNDS

BUFFER CAR (5 CARS)

WT. 250,000 POUNDS

IMPACT NO.	END STRUCK	VELOCITY (MPH)	REMARKS
------------	------------	----------------	---------

1	Forward	4.65	<p>Impact end moved . inch.  Middle pod moved 1-1/4 inches.  Gap at forward end 1-1/2 inches.  At impact end and at first gate, the steel under the rubber skids cut into the 2 x 6 verticals. The end gate at the impact end resulted in the steel cutting and fracturing the first 2 x 6 it contacted. FAILURE.</p>
2	Forward	4.50	<p>Impact end moved 3/4 inch.  Middle moved 1 inch. End moved two inches.  Second impact increased penetration of the steel on rubber skid into the wood.  FAILURE.</p>

RAIL IMPACT TEST

TEST NO: 3

DATE: 07 JUNE 1989

TEST SPECIMEN: ATACMS in a boxcar with 12 instrumentation channels. Braced load with triangle piece of plywood at steel angle.

TEST CAR NO: RBOX 40247

LT. WT. 63,100 POUNDS

LADING AND DUNNAGE

WT. 32,000 POUNDS

TOTAL SPECIMEN WT. 95,100 POUNDS

BUFFER CAR (5 CARS) WT. 250,000 POUNDS

IMPACT NO.	END STRUCK	VELOCITY (MPH)	REMARKS
------------	------------	----------------	---------

1	Forward	4.26	Load moved one inch breaking through triangle piece of plywood. Cut 3/8 inch into plywood.
2	Forward	6.41	Rear pod moved 3/4 inch. Angle cut into plywood. FAILED.

RAIL IMPACT TEST

TEST NO: 4

DATE: 13 JUNE 1989

TEST SPECIMEN: ATACMS in a boxcar with dunnage full height of 2 layers and has a hardwood piece of dunnage against the rubber skids and steel angles.

TEST CAR NO: RBOX 40247

LT. WT. 63,100 POUNDS

LADING AND DUNNAGE

WT. 32,000 POUNDS

TOTAL SPECIMEN WT. 95,100 POUNDS

BUFFER CAR (5 CARS) WT. 250,000 POUNDS

IMPACT NO.	END STRUCK	VELOCITY (MPH)	REMARKS
1	Forward	4.41	Middle moved 3/8 inch. Impact end moved 1/8 inch. Tended hardwood dunnage approx 1/32 inch.
2	Forward	6.43	Middle moved 1/8 inch. Impact end dented hardwood 1/16 inch.
3	Forward	8.52	No Change.
4	Reverse	8.33	Moved 3/4 inch at center. Moved one inch at impact end. Measured 1/16 inch into hard wood at end impacted at 4, 6, and 8 mph.

RESULTS FROM THE RAIL IMPACT TEST OF THE ATACMS  
DATE: 13 JUNE 1989

TAPE CHANNEL 1 : LONGITUDINAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.41	-1.99	71.93	.0830
IMPACT 2	6.43	-2.10	57.07	.0789
IMPACT 3	8.52	-3.12	48.25	.1095
IMPACT 4 (REVERSE)	8.33	-6.00	24.21	.0842

TAPE CHANNEL 2 : LATERAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.41	-.16	18.73	.0018
IMPACT 2	6.43	-.15	15.04	.0015
IMPACT 3	8.52	-.17	21.51	.0019
IMPACT 4 (REVERSE)	8.33	-.92	20.64	.0151

TAPE CHANNEL 3 : VERTICAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.41	-.56	17.63	.0054
IMPACT 2	6.43	.70	14.83	.0048
IMPACT 3	8.52	1.27	17.09	.0052
IMPACT 4 (REVERSE)	8.33	-3.25	29.15	.0587

TAPE CHANNEL 4 : LONGITUDINAL ACCELERATION ON CENTER BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.41	-2.08	61.08	.0809
IMPACT 2	6.43	-2.28	60.58	.0888
IMPACT 3	8.52	-3.23	47.42	.1104
IMPACT 4 (REVERSE)	8.33	3.66	36.02	.0920

TAPE CHANNEL 5 : LATERAL ACCELERATION ON CENTER BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.41	*****	*****	*****
IMPACT 2	6.43	-.02	28.92	.0004
IMPACT 3	8.52	-.02	26.91	.0002
IMPACT 4 (REVERSE)	8.33	.55	37.32	.0128

TAPE CHANNEL 6 : RAIL COUPLER FORCE

TEST	SPEED MPH	PEAK VALUE POUNDS	DURATION MILLISECONDS	AREA POUNDS-SECONDS
IMPACT 1	4.41	152293.45	65.45	6651.00
IMPACT 2	6.43	210357.91	54.41	7095.99
IMPACT 3	8.52	256711.25	55.83	9281.65
IMPACT 4 (REVERSE)	8.33	211641.78	48.95	8617.17

TAPE CHANNEL 7 : VERTICAL ACCELERATION ON CENTER BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.41	-.59	24.85	.0116
IMPACT 2	6.43	-.15	34.56	.0031
IMPACT 3	8.52	-.10	27.84	.0015
IMPACT 4 (REVERSE)	8.33	-.08	23.96	.0014

TAPE CHANNEL 8 : LONGITUDINAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.41	-1.99	62.24	.0786
IMPACT 2	6.43	-2.17	57.29	.0847
IMPACT 3	8.52	-3.15	46.49	.1112
IMPACT 4 (REVERSE)	8.33	3.23	40.67	.0939

TAPE CHANNEL 9 : LATERAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.41	.14	32.38	.0029
IMPACT 2	6.43	.14	28.12	.0022
IMPACT 3	8.52	-7.30	107.21	.2398
IMPACT 4 (REVERSE)	8.33	-8.37	95.15	.3773

TAPE CHANNEL 10 : VERTICAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.41	-.20	17.48	.0016
IMPACT 2	6.43	.38	15.70	.0031
IMPACT 3	8.52	.77	16.79	.0055
IMPACT 4 (REVERSE)	8.33	.79	15.36	.0043

TAPE CHANNEL 11 : LONGITUDINAL ACCELERATION ON CAR FLOOR

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.41	-.94	70.40	.0335
IMPACT 2	6.43	-1.22	38.69	.0272
IMPACT 3	8.52	*****	*****	*****
IMPACT 4 (REVERSE)	8.33	*****	*****	*****

TAPE CHANNEL 12 : LATERAL ACCELERATION ON CAR FLOOR

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.41	-.04	14.29	.0002
IMPACT 2	6.43	.07	22.47	.0009
IMPACT 3	8.52	-.16	33.44	.0036
IMPACT 4 (REVERSE)	8.33	-8.21	140.55	.7489

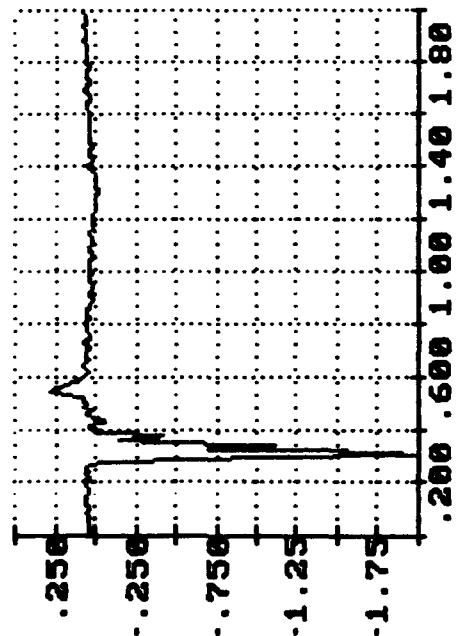
TAPE CHANNEL 14 : VERTICAL ACCELERATION ON CAR FLOOR

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.41	-.29	18.60	.0031
IMPACT 2	6.43	-.32	12.01	.0018
IMPACT 3	8.52	-2.86	22.20	.0407
IMPACT 4 (REVERSE)	8.33	-3.05	97.65	.1653

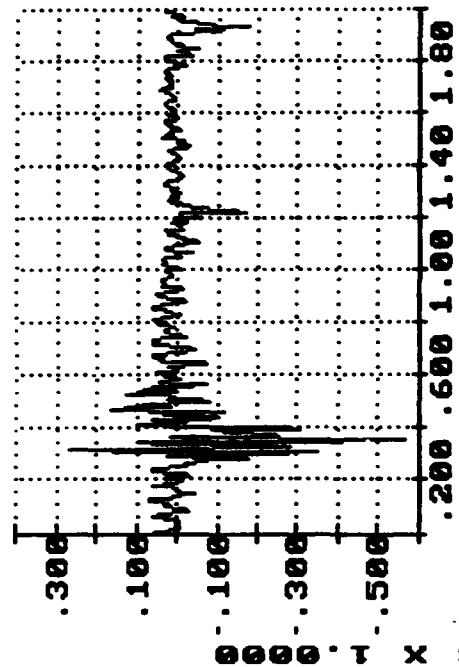
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RAIL IMPACT TEST OF ATACMS  
DATE: 13 JUNE 1989  
SPEED: 4.41 MPH

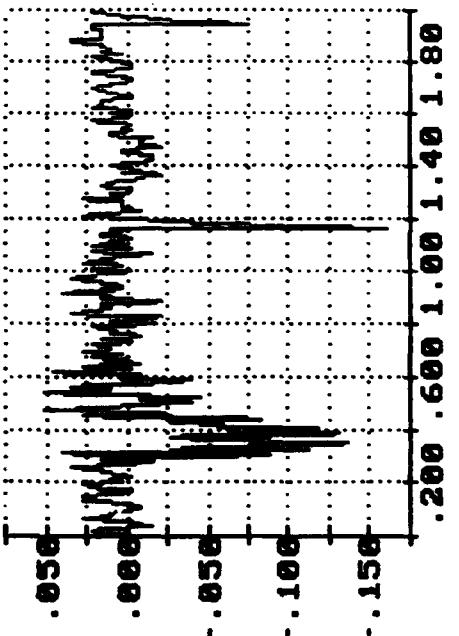


LATERAL ACCELERATION -  
ON FORWARD BLOCK  
ATION ON FORWARD BLOCK  
IN G'S X 1.0000



LONGITUDINAL ACCELERATION -  
ATION ON CENTER BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
x 1.0000



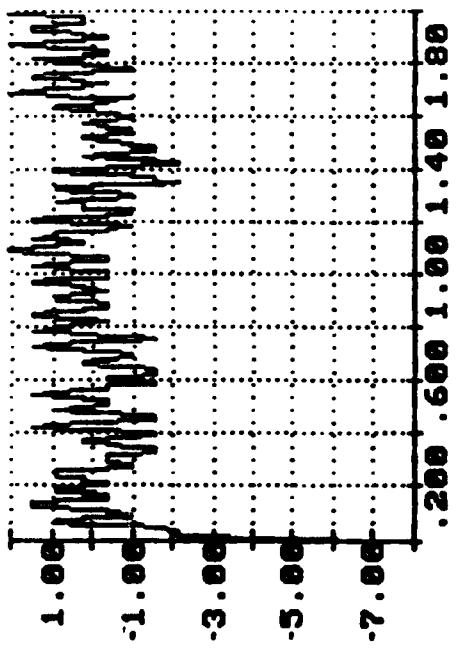
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ON FORWARD BLOCK  
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IN G'S X 1.0000

Sample Time in Seconds

x 1.0000

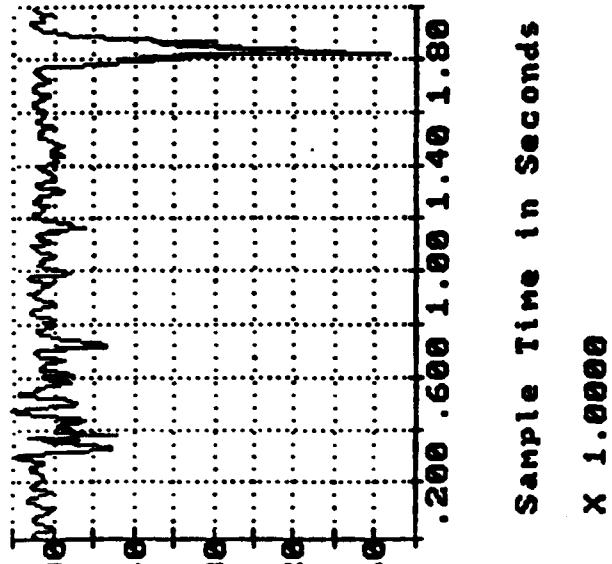
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RAIL IMPACT TEST OF ATACMS  
DATE: 13 JUNE 1989  
SPEED: 4.41 MPH

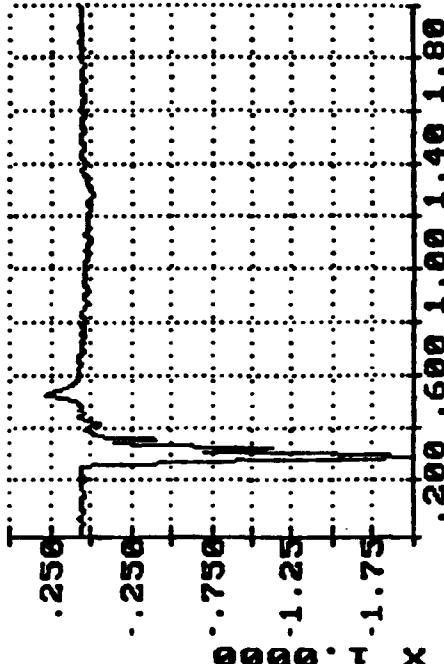


RAIL COUPLER FORCE  
LATERAL ACCELERATION -  
ON CENTER BLOCK

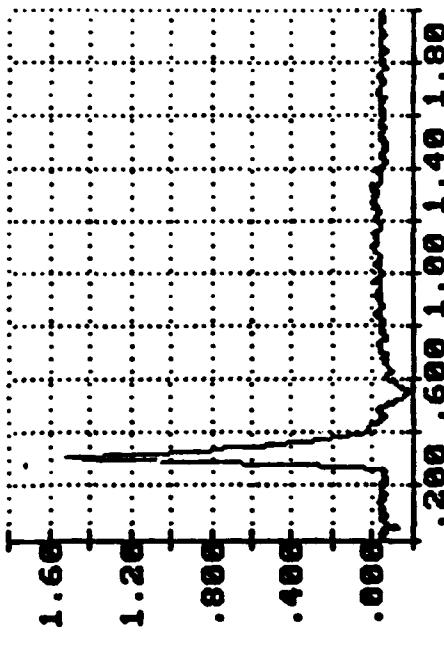
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IN G.S X 1.00000



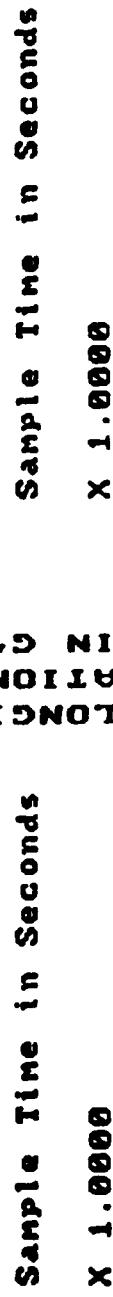
VERTICAL ACCELERATION  
IN ON CENTER BLOCK



LONGITUDINAL ACCELERATION  
IN G.S X 1.00000

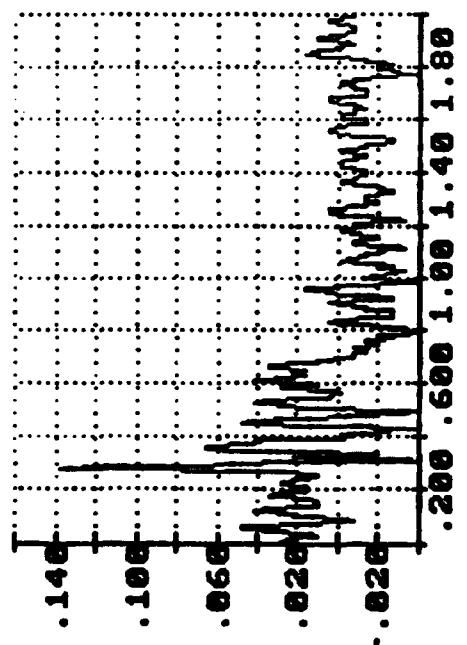


ACCELERATION ON REAR BLOCK  
IN G.S X 1.00000



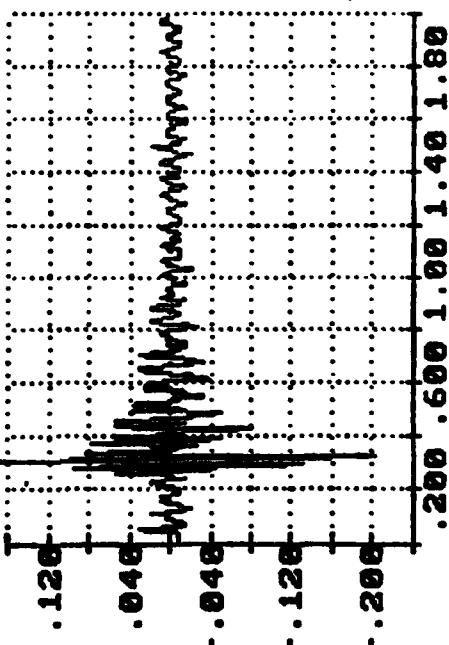
ACCELERATION ON CENTER BLOCK  
IN G.S X 1.00000

RAIL IMPACT TEST OF ATTACHES  
DATE: 13 JUNE 1989  
SPEED: 4.41 MPH

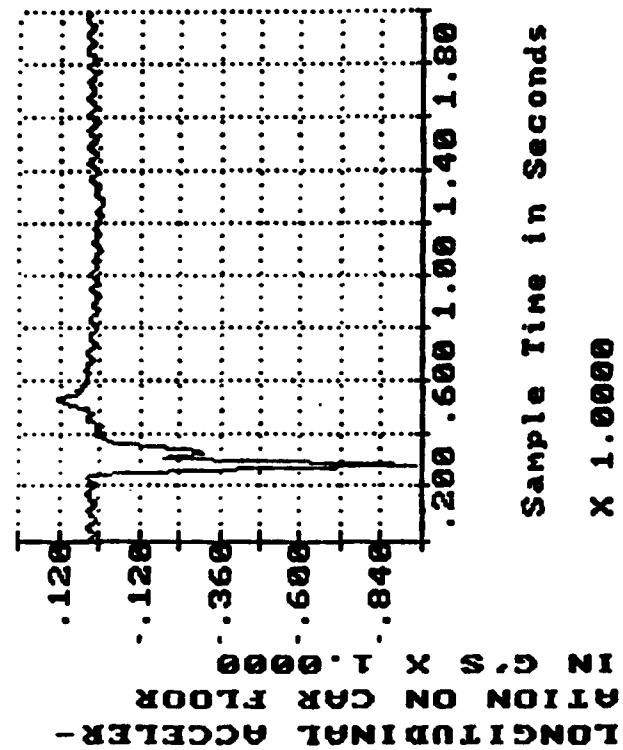


Sample Time in Seconds  
x 1.0000

IN G'S X 1.0000

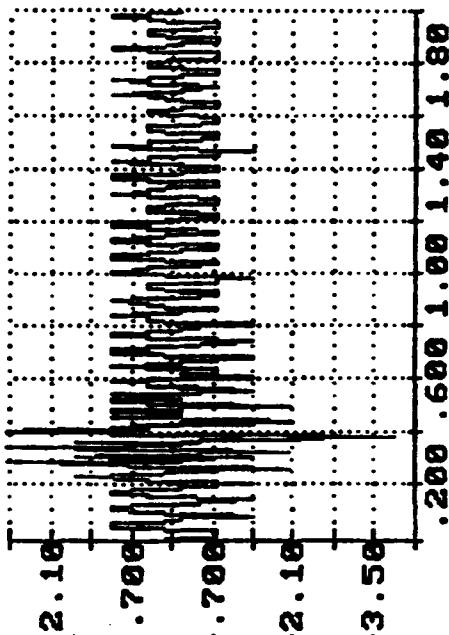


IN G'S X 1.0000

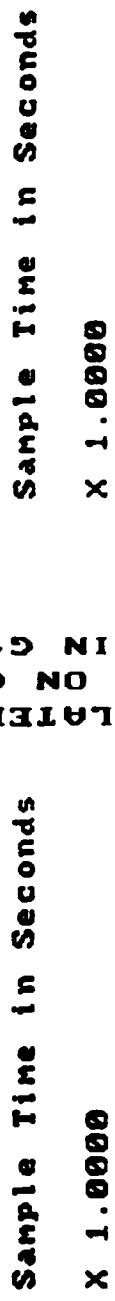


Sample Time in Seconds  
x 1.0000

IN G'S X 1.0000

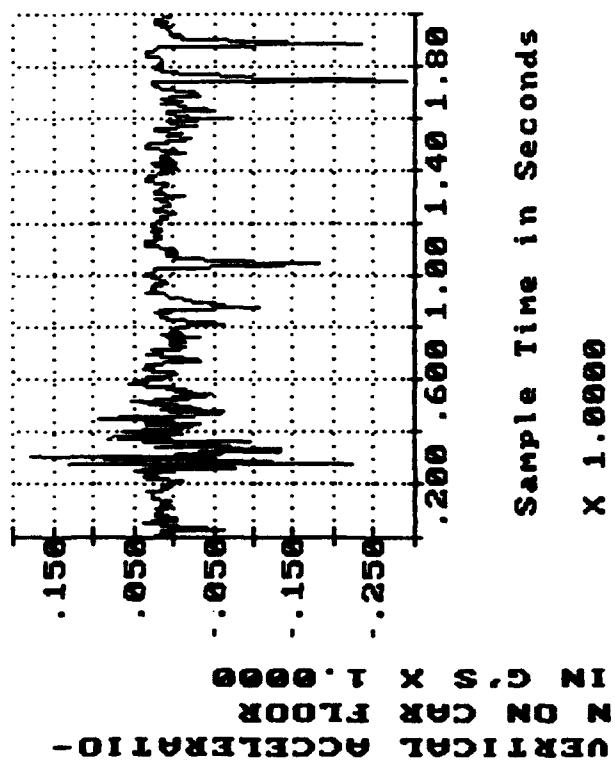


IN G'S X 0.1000

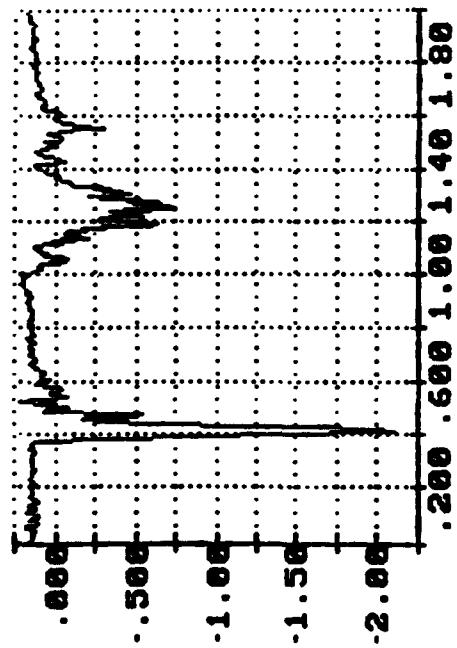


Sample Time in Seconds  
x 1.0000

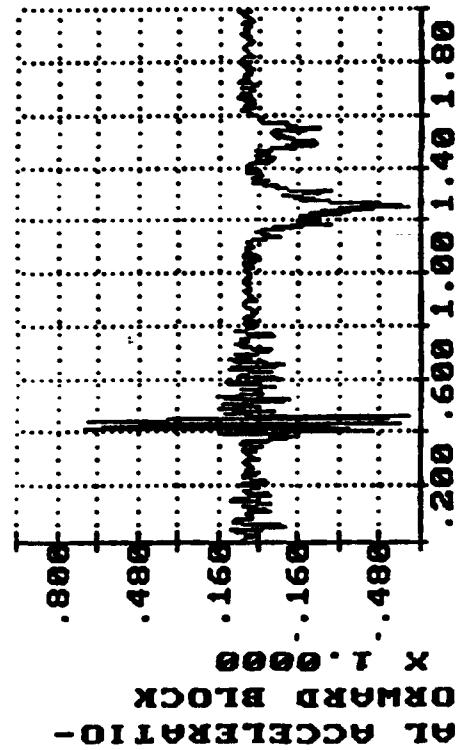
RAIL IMPACT TEST OF ATACMS  
DATE: 13 JUNE 1989  
SPEED: 4.41 MPH



RAIL IMPACT TEST OF ATACHS  
DATE: 13 JUNE 1989  
SPEED: 6.43 MPH

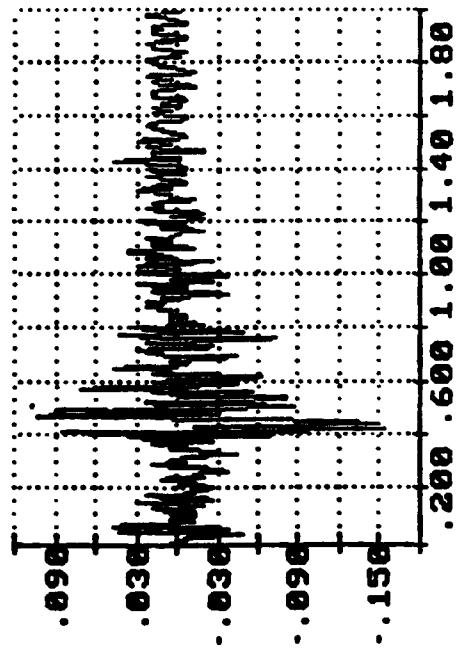


LATERAL ACCELERATION  
ON FORWARD BLOCK  
ACTION ON FORWARD BLOCK  
IN G'S X 1.0000

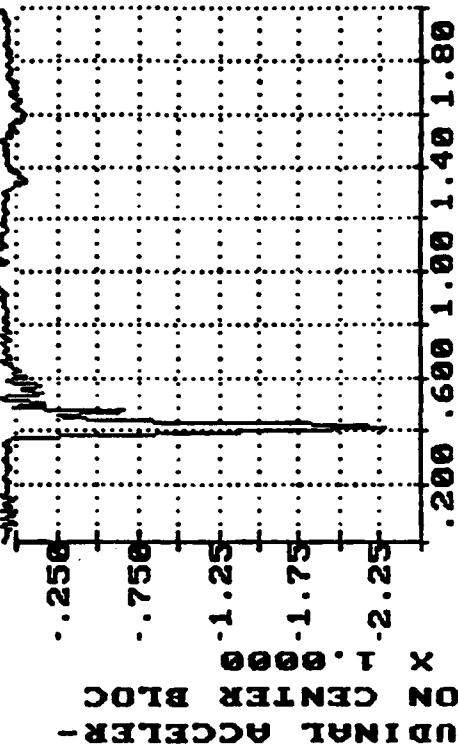


LONGITUDINAL ACCELERATION  
ACTION ON CENTER BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000



LATERAL ACCELERATION  
ON FORWARD BLOCK  
ACTION ON FORWARD BLOCK  
IN G'S X 1.0000



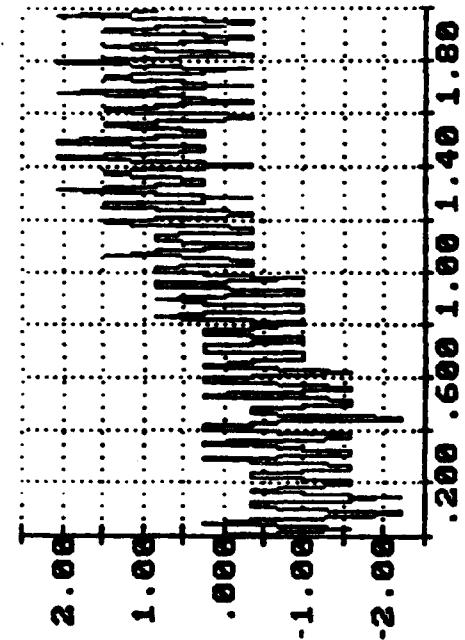
LONGITUDINAL ACCELERATION  
ACTION ON CENTER BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000

Sample Time in Seconds  
X 1.0000

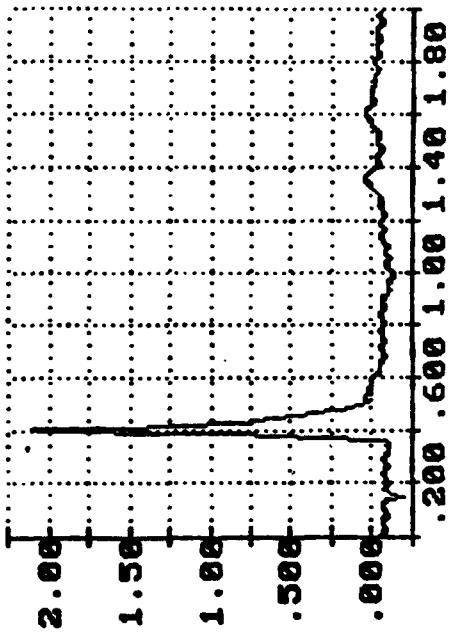
X 1.0000

X611 IMPACT TEST OF AIRACMS  
DATE: 13 JUNE 1969  
SPEED: 6.43 MPH

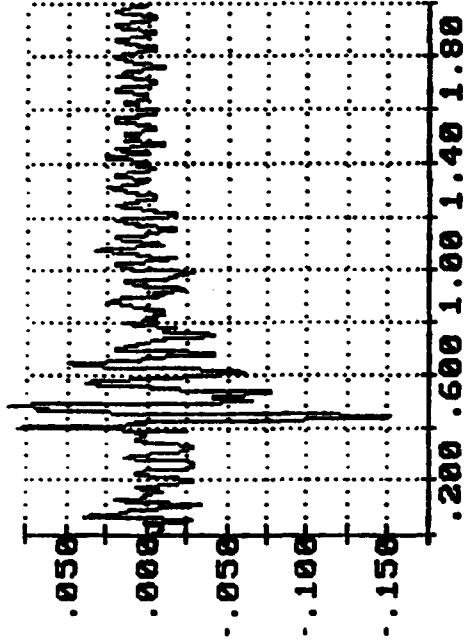


RAIL COUPLER FORCE  
LATERRAL ACCELERATION -  
ON CENTER BLOCK IN POUNDS X 100000 .0000 IN G.S X .0100

Sample Time in Seconds  
X 1.0000

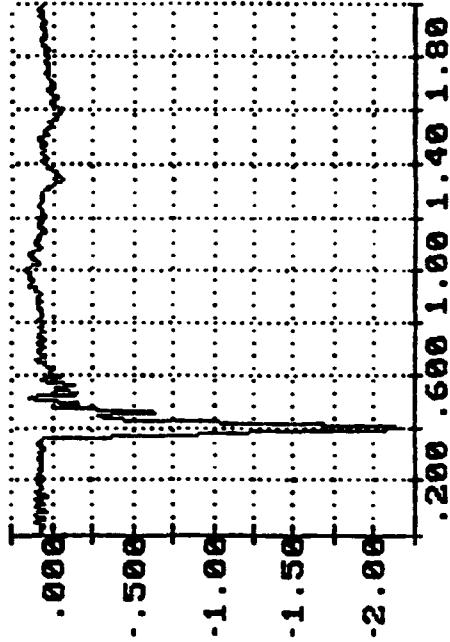


Sample Time in Seconds  
X 1.0000



VERTICAL ACCELERATION -  
IN G.S X 1.0000  
ON CENTER BLOCK

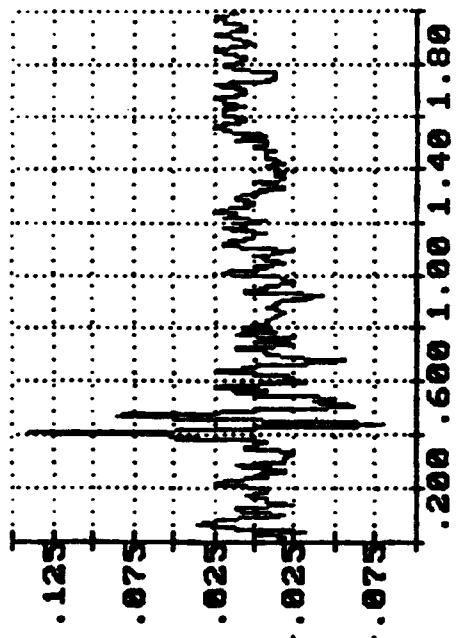
Sample Time in Seconds  
X 1.0000



LONGITUDINAL ACCELERATION -  
IN G.S X 1.0000  
ATIION ON REAR BLOCK

Sample Time in Seconds  
X 1.0000

RAIL IMPACT TEST OF ATTACHES  
DATE: 13 JUNE 1989  
SPEED: 6.43 MPH



IN G.S X 1.0000

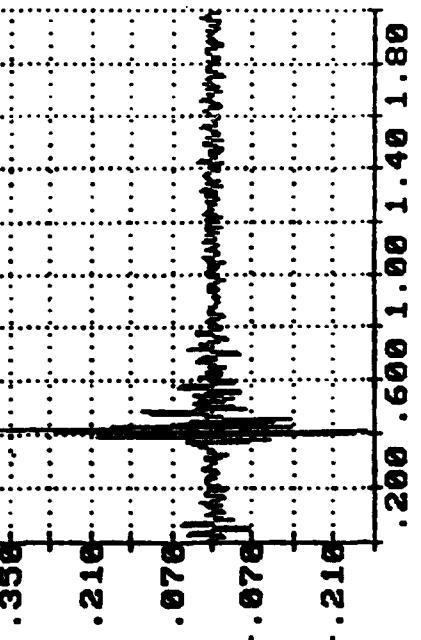
LATERAL ACCELERATION -

ON REAR BLOCK

4-15



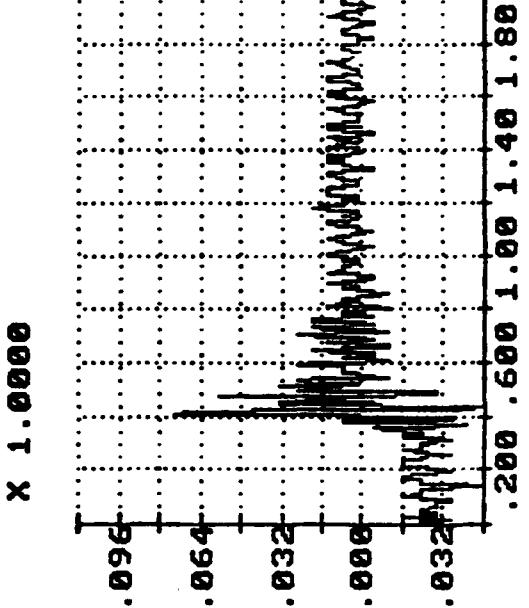
IN G.S X 1.0000



IN G.S X 1.0000

VERTICAL ACCELERATION -

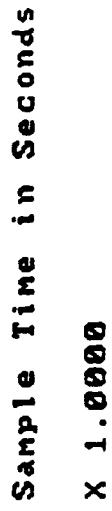
ON REAR BLOCK



IN G.S X 1.0000

LATERAL ACCELERATION -

ON CAR FLOOR



IN G.S X 1.0000

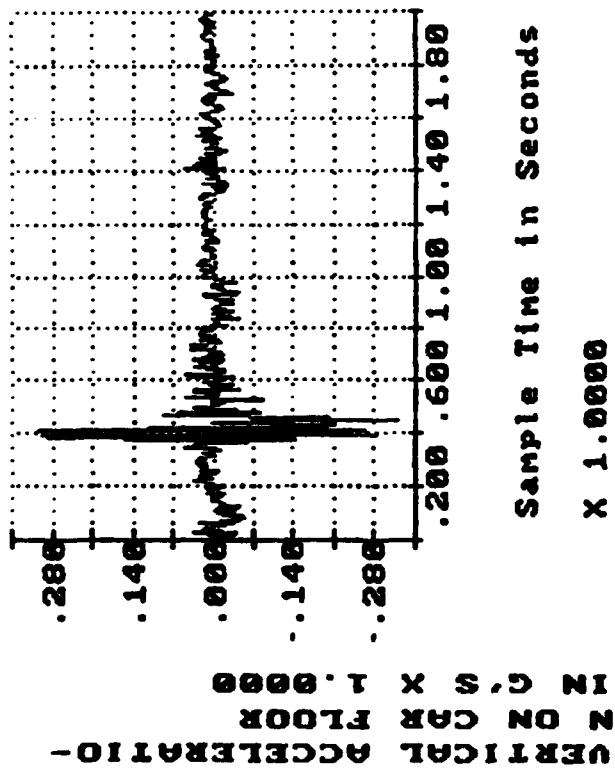
Sample Time in Seconds

Sample Time in Seconds

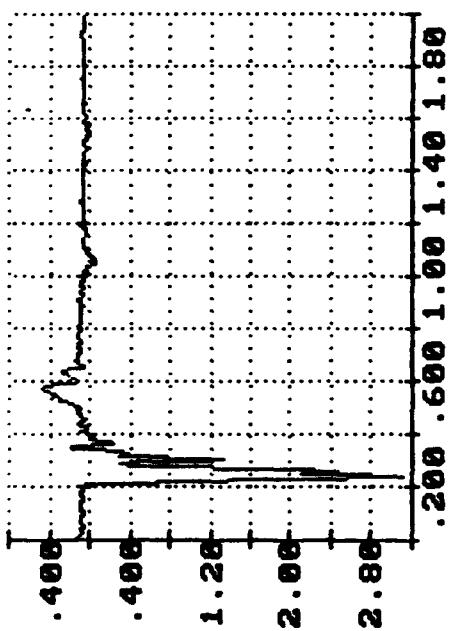
Sample Time in Seconds

Sample Time in Seconds

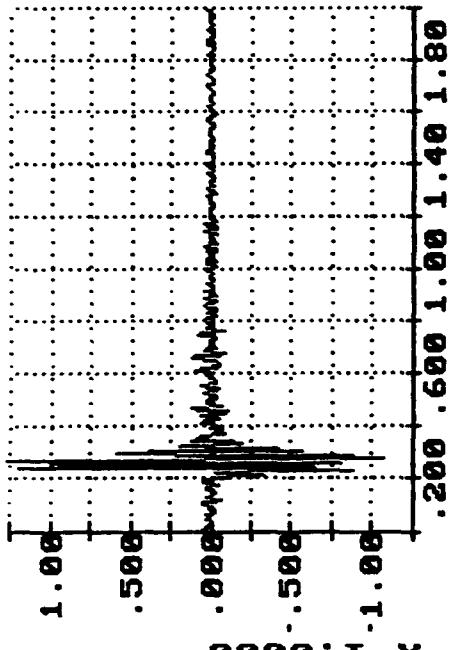
RAIL IMPACT TEST OF ALARMS  
DATE: 13 JUNE 1989  
SPEED: 6.43 MPH



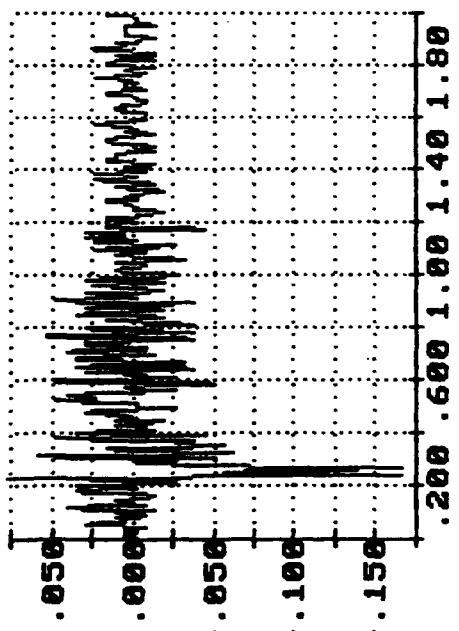
REAL IMPACT TEST OF AIRACIDS  
DATE: 13 JUNE 1989  
SPEED: 8.52 MPH



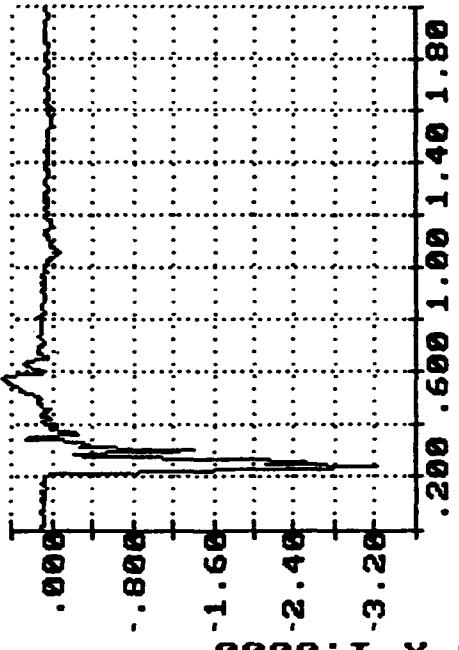
LONGITUDINAL ACCELERATION  
ON FORWARD BLOCK  
ATTION ON FORWARD BLOCK  
IN G'S X 1.0000  
Sample Time in Seconds  
X 1.0000



VERTICAL ACCELERATION  
ON FORWARD BLOCK  
ATTION ON FORWARD BLOCK  
IN G'S X 1.0000  
Sample Time in Seconds  
X 1.0000



LATERAL ACCELERATION  
ON FORWARD BLOCK  
ATTION ON FORWARD BLOCK  
IN G'S X 1.0000  
Sample Time in Seconds  
X 1.0000

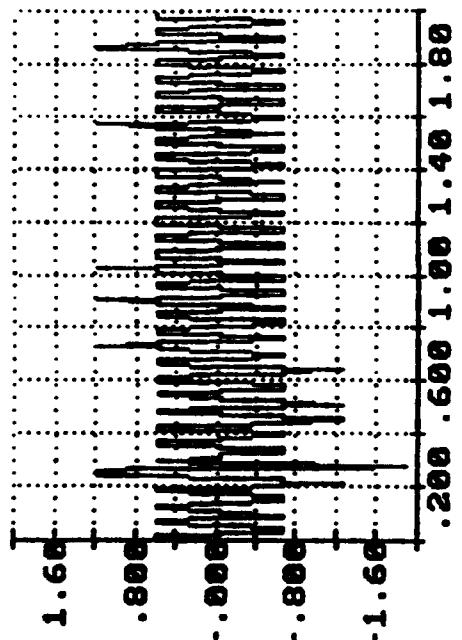


LONGITUDINAL ACCELERATION  
ATTION ON CENTER BLOCK  
ATTION ON CENTER BLOCK  
IN G'S X 1.0000  
Sample Time in Seconds  
X 1.0000



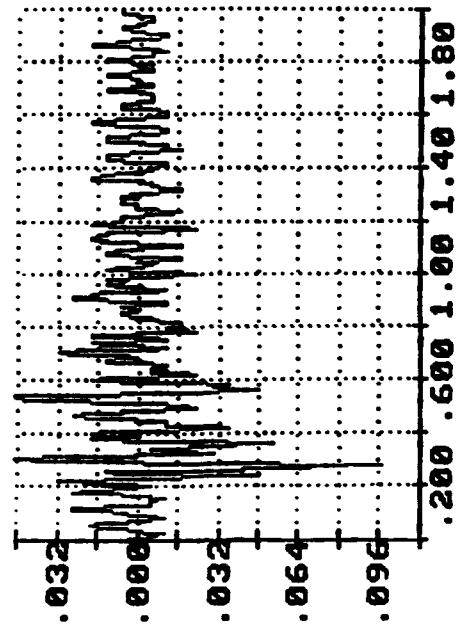
VERTICAL ACCELERATION  
ATTION ON CENTER BLOCK  
ATTION ON CENTER BLOCK  
IN G'S X 1.0000  
Sample Time in Seconds  
X 1.0000

RAIL IMPACT TEST OF ATACMS  
DATE: 13 JUNE 1989  
SPEED: 8.52 MPH



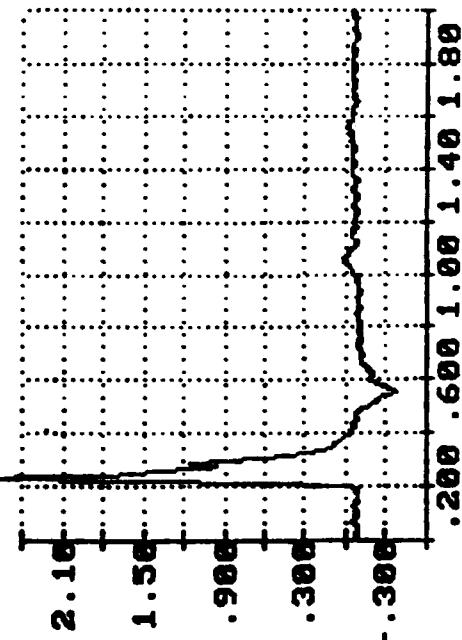
RAIL COUPLER FORCE  
LATERRAL ACCELERATION-  
ON CENTER BLOCK  
IN POUNDS X 1000000.0000 IN G.S X .0100

Sample Time in Seconds  
X 1.0000

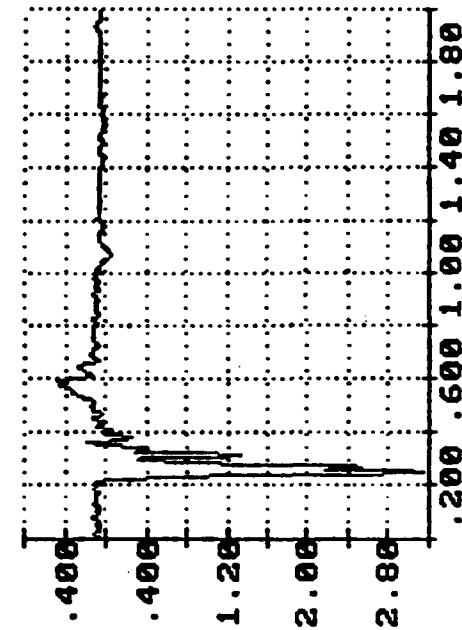


LONGITUDINAL ACCELERATION-  
ACTION ON REAR BLOCK  
IN G.S X 1.0000

Sample Time in Seconds  
X 1.0000



RAIL COUPLER FORCE  
LATERRAL ACCELERATION-  
ON CENTER BLOCK  
IN POUNDS X 1000000.0000 IN G.S X .0100



LONGITUDINAL ACCELERATION-  
ACTION ON REAR BLOCK  
IN G.S X 1.0000

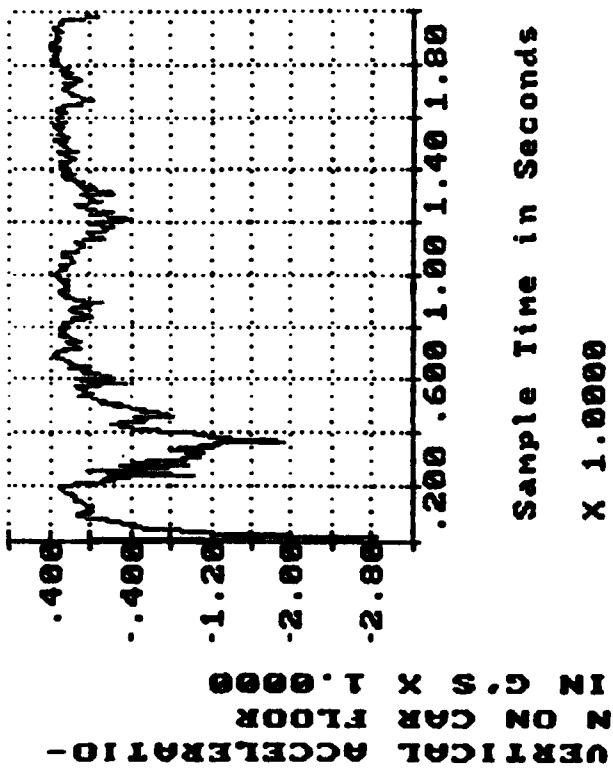
Sample Time in Seconds  
X 1.0000



RAIL COUPLER FORCE  
LATERRAL ACCELERATION-  
ON CENTER BLOCK  
IN POUNDS X 1000000.0000 IN G.S X .0100

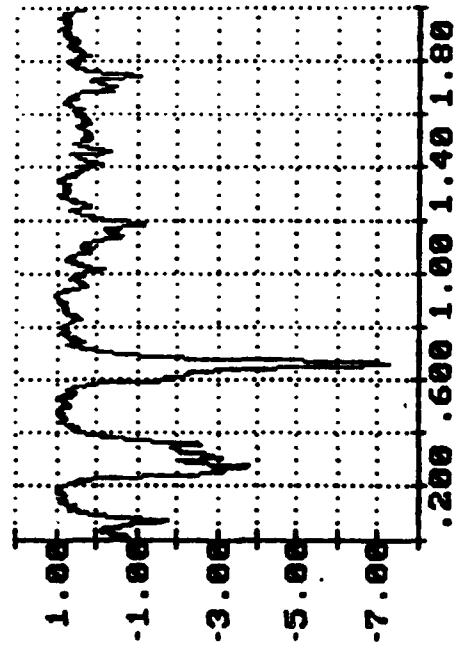
Sample Time in Seconds  
X 1.0000

TAIL IMPACT TEST OF ATTACHES  
DATE: 13 JUNE 1989  
SPEED: 8.52 MPH



VERTICAL ACCELERATION  
IN ON CAR FLOOR

RAIL IMPACT TEST OF ATACMS  
DATE: 13 JUNE 1989  
SPEED: 8.52 MPH

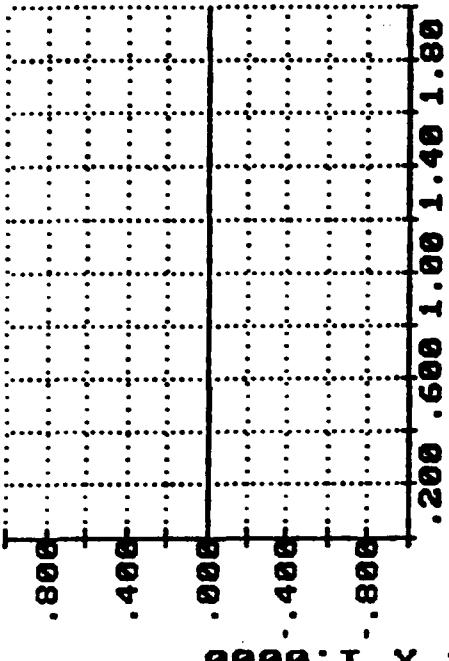


IN G'S X 1.0000

LATERAL ACCELERATION  
ON REAR BLOCK

IN G'S X 1.0000

IN G'S X 1.0000



IN G'S X 1.0000

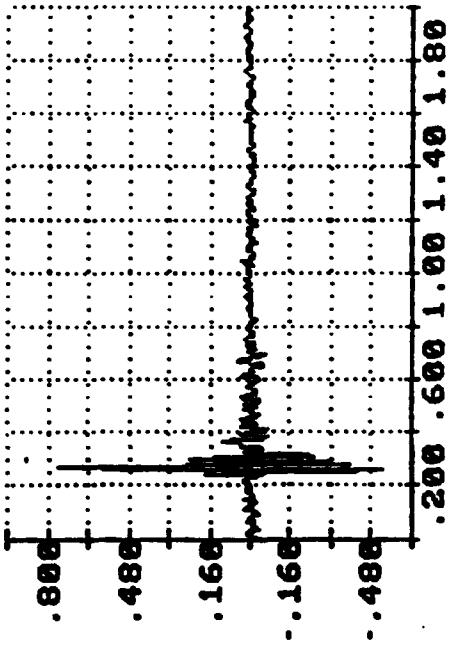
LONGITUDINAL ACCELERATION

ON CAR FLOOR

IN G'S X 1.0000

IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000



IN G'S X 1.0000

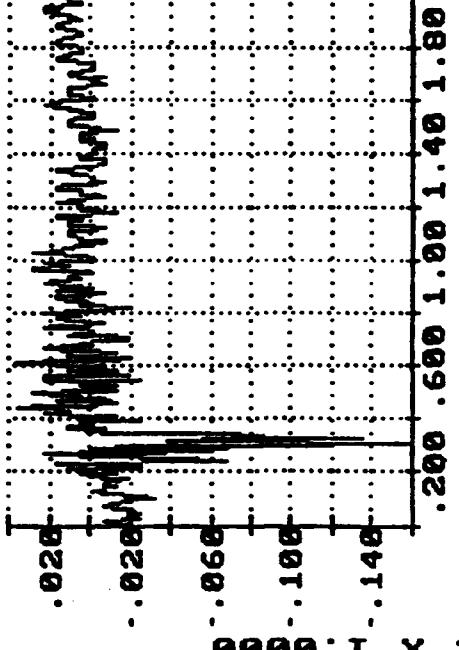
VERTICAL ACCELERATION  
ON REAR BLOCK

IN G'S X 1.0000

IN G'S X 1.0000

LATERAL ACCELERATION  
ON CAR FLOOR  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000



IN G'S X 1.0000

LATERAL ACCELERATION

ON CAR FLOOR

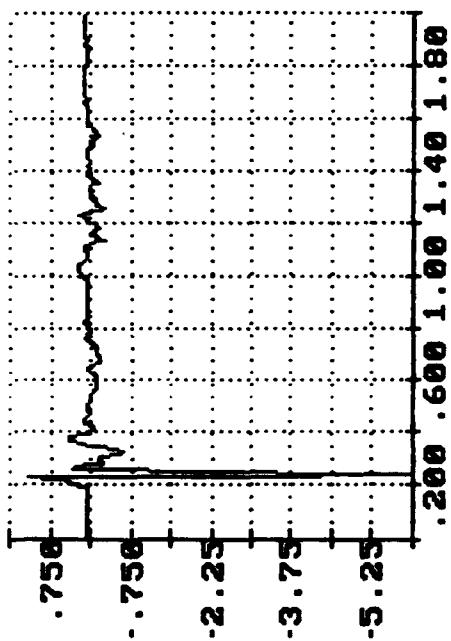
IN G'S X 1.0000

IN G'S X 1.0000

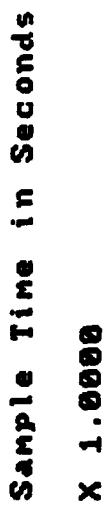
Sample Time in Seconds  
X 1.0000

Sample Time in Seconds  
X 1.0000

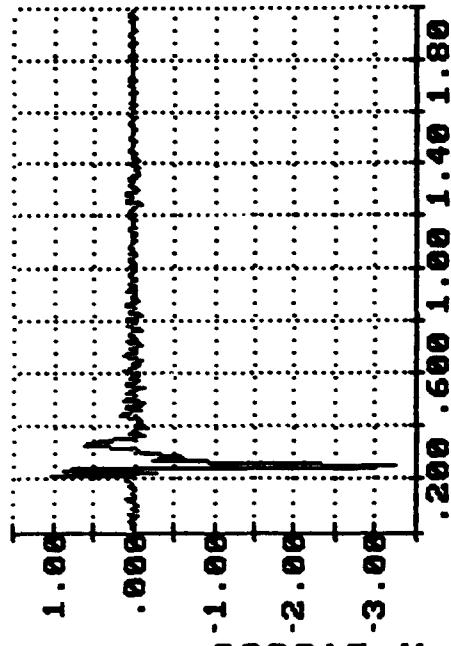
RAIL IMPACT TEST OF ATACMS  
DATE: 13 JUNE 1989  
SPEED: 8.33 MPH (REVERSE)



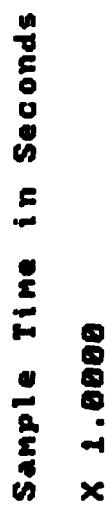
LATERAL ACCELERATION  
ON FORWARD BLOCK  
ATION ON FORWARD BLOCK  
IN G'S X 1.0000



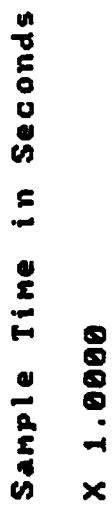
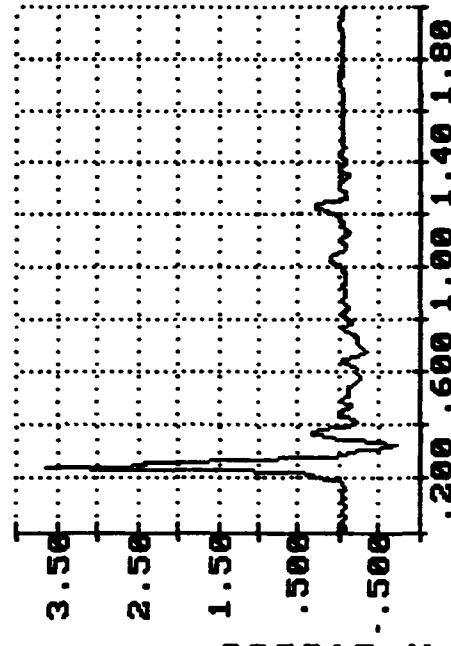
LATERAL ACCELERATION  
ON FORWARD BLOCK  
ATION ON FORWARD BLOCK  
IN G'S X 1.0000



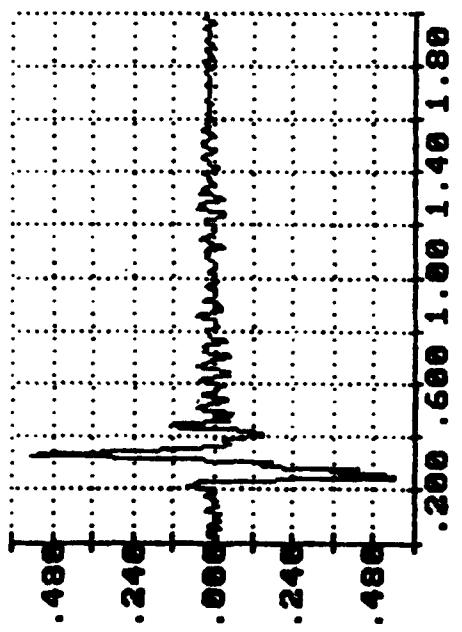
VERTICAL ACCELERATION  
ON FORWARD BLOCK  
IN G'S X 1.0000



LONGITUDINAL ACCELER-  
ATION ON CENTER BLOCK  
ATION ON CENTER BLOCK  
IN G'S X 1.0000



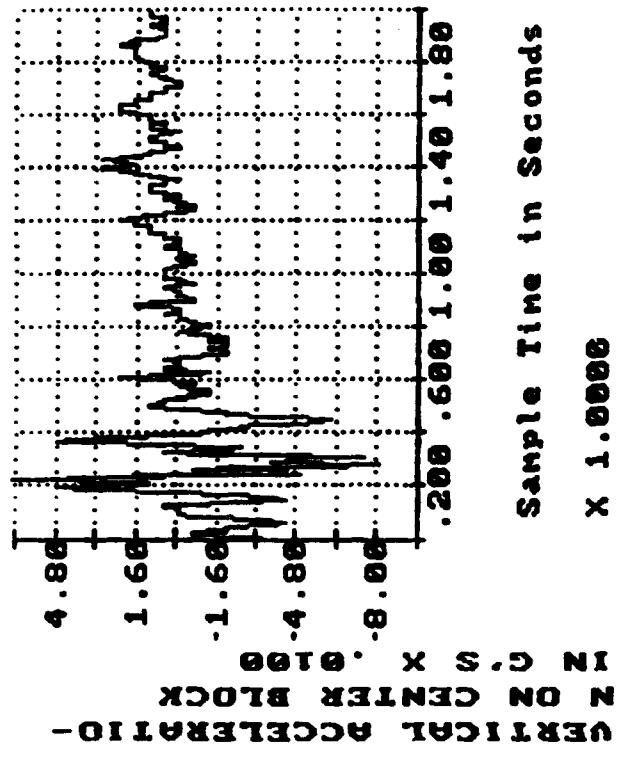
RAIL IMPACT TEST OF ATACMS  
DATE: 13 JUNE 1989  
SPEED: 8.33 MPH (REVERSE)



LATERAL ACCELERATION  
ON CENTER BLOCK  
RAIL COUPLER FORCE

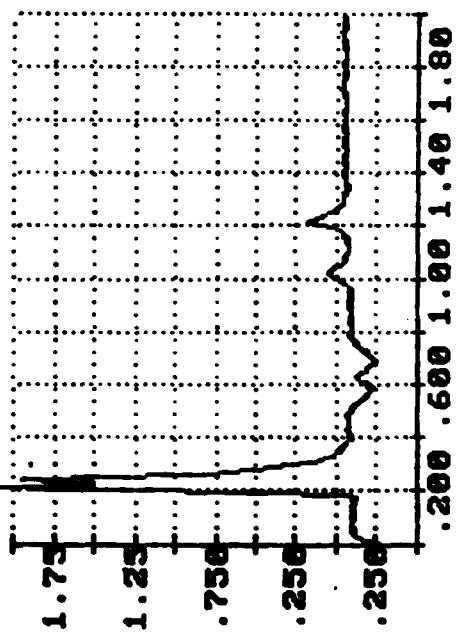
Sample Time in Seconds  
x 1.0000

IN POUNDS X 1000000.0000 IN G.S X 1.0000  
RAIL COUPLER FORCE

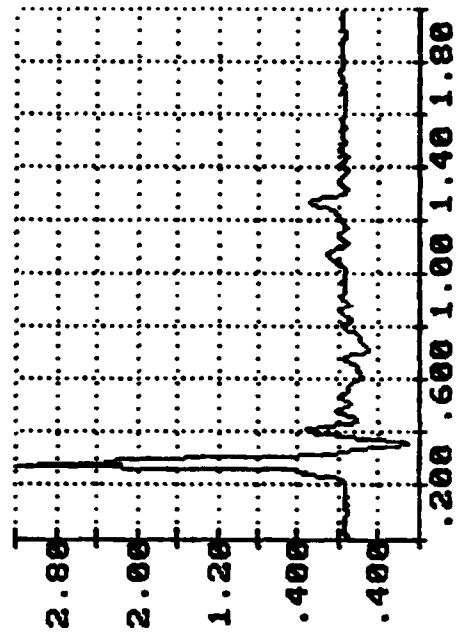


VERTICAL ACCELERATION  
IN ON CENTER BLOCK  
RAIL COUPLER FORCE

Sample Time in Seconds  
x 1.0000



LONGITUDINAL ACCELERATION  
IN G.S X 1.0000  
ATTION ON REAR BLOCK

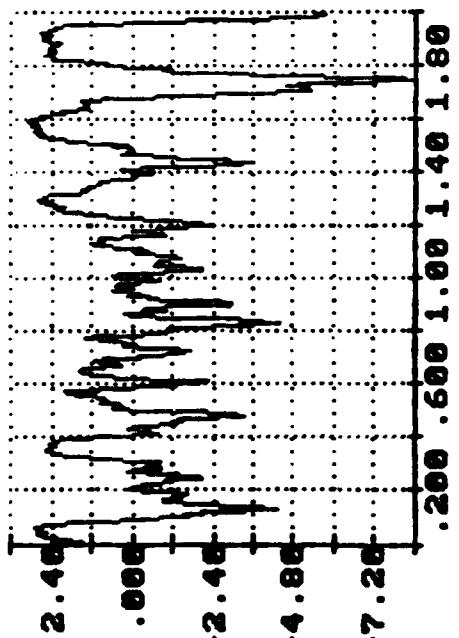


Sample Time in Seconds  
x 1.0000

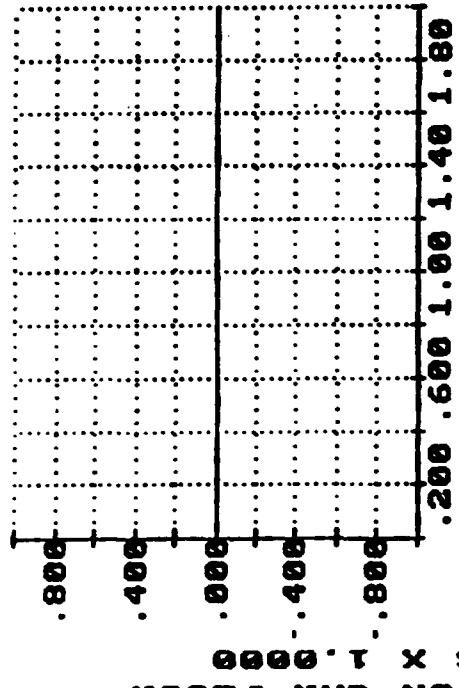
Sample Time in Seconds  
x 1.0000

Sample Time in Seconds  
x 1.0000

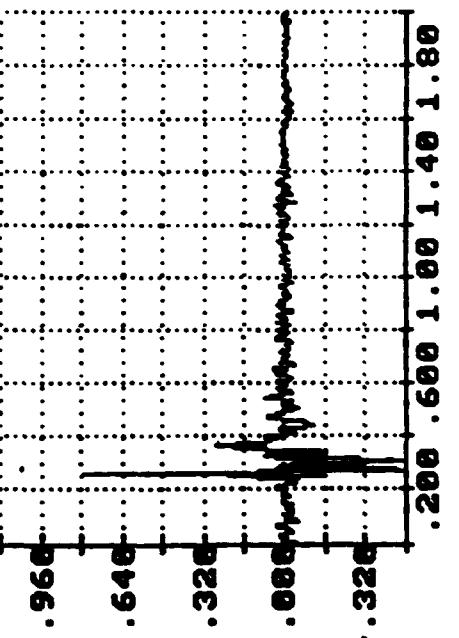
KAHL IMPACT TEST OF AIRBAGS  
DATE: 13 JUNE 1989  
SPEED: 8.33 MPH (REVERSE)



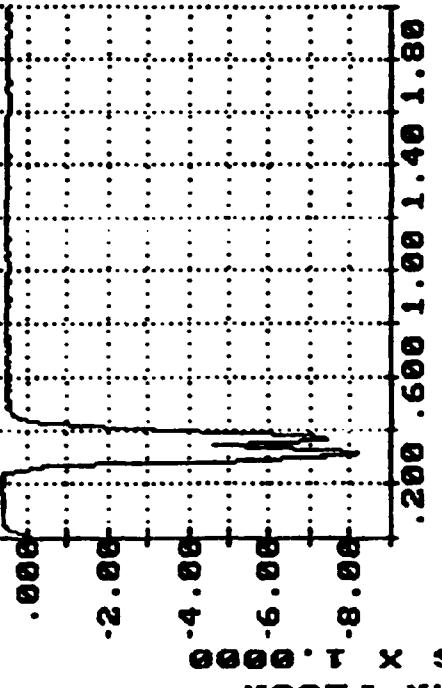
Sample Time in Seconds  
X 1.0000



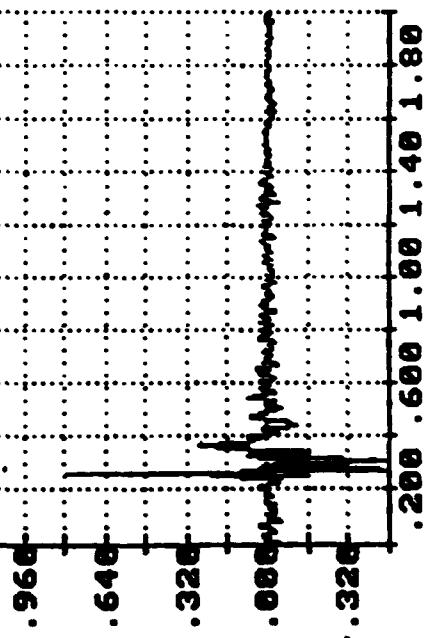
Sample Time in Seconds  
X 1.0000



Sample Time in Seconds  
X 1.0000

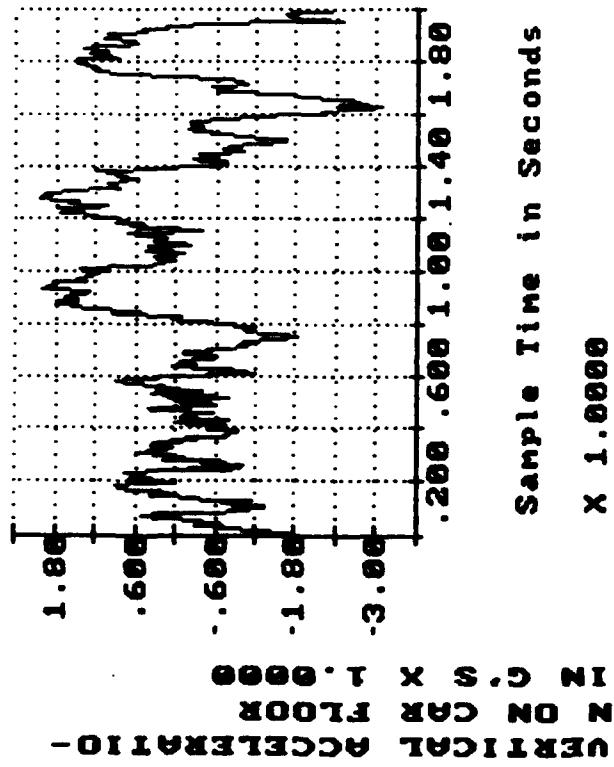


Sample Time in Seconds  
X 1.0000



Sample Time in Seconds  
X 1.0000

RAIL IMPACT TEST OF ATACMS  
DATE: 13 JUNE 1989  
SPEED: 8.33 MPH (REVERSE)



RAIL IMPACT TEST

TEST NO. 5

DATE: 11 JULY 1989

TEST SPECIMEN: ATACMS in Boxcar

TEST CAR NO. RBOX 40247

LT. WT. 63,100 POUNDS

LADING AND DUNNAGE

WT. 32,000 POUNDS

TOTAL SPECIMEN

WT. 95,100 POUNDS

BUFFER CAR (5 CARS)

WT. 250,000 POUNDS

IMPACT NO.	END STRUCK	VELOCITY (MPH)	REMARKS
1	Forward	4.49	Middle moved forward 1/4 inch.
2	Forward	6.29	Gap at forward end 1/2 inch.
3	Forward	8.33	Second strut was dislodged. Put in wrong position during loading.
4	Reverse	8.19	No damage.

RESULTS FROM RAIL IMPACT TESTING  
OF ATACMS IN BOXCAR  
DATE: 11 JULY 1989

TAPE CHANNEL 1 : LONGITUDINAL ACCELERATION FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.49	-1.74	47.38	.0538
IMPACT 2	6.29	-2.13	84.65	.0994
IMPACT 3	8.33	-3.35	46.90	.0941
IMPACT 4 (REVERSE)	8.19	5.69	39.48	.1230

TAPE CHANNEL 2 : LATERAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.49	-.20	24.51	.0029
IMPACT 2	6.29	-.25	32.26	.0029
IMPACT 3	8.33	-.29	37.20	.0056
IMPACT 4 (REVERSE)	8.19	-1.33	13.74	.0128

TAPE CHANNEL 3 : VERTICAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.49	.31	13.25	.0024
IMPACT 2	6.29	.59	15.31	.0051
IMPACT 3	8.33	1.33	13.94	.0103
IMPACT 4 (REVERSE)	8.19	-3.08	17.30	.0382

TAPE CHANNEL 4 : LONGITUDINAL ACCELERATION ON MIDDLE BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.49	-1.84	47.04	.0563
IMPACT 2	6.29	-2.23	75.80	.0979
IMPACT 3	8.33	-3.51	41.19	.0966
IMPACT 4 (REVERSE)	8.19	4.23	31.18	.0824

TAPE CHANNEL 5 : LATERAL ACCELERATION MIDDLE BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.49	.15	55.22	.0042
IMPACT 2	6.29	.08	12.16	.0006
IMPACT 3	8.33	-.10	15.84	.0010
IMPACT 4 (REVERSE)	8.19	.75	18.96	.0077

TAPE CHANNEL 6 : RAIL COUPLER FORCE

TEST	SPEED MPH	PEAK VALUE POUNDS	DURATION MILLISECONDS	AREA POUNDS-SECONDS
IMPACT 1	4.49	127587.32	107.27	6223.30
IMPACT 2	6.29	195302.97	58.09	7045.33
IMPACT 3	8.33	254527.34	46.22	7959.51
IMPACT 4 (REVERSE)	8.19	211995.84	43.35	6945.94

TAPE CHANNEL 7 : VERTICAL ACCELERATION ON MIDDLE BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.49	-.23	53.70	.0071
IMPACT 2	6.29	-.26	45.08	.0059
IMPACT 3	8.33	-.38	73.52	.0039
IMPACT 4 (REVERSE)	8.19	-.11	36.36	.0019

TAPE CHANNEL 8 : LONGITUDINAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.49	-1.74	48.34	.0558
IMPACT 2	6.29	-2.14	81.59	.0994
IMPACT 3	8.33	-3.37	40.77	.0946
IMPACT 4 (REVERSE)	8.19	6.04	30.39	.1120

TAPE CHANNEL 9 : LATERAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.49	.18	75.01	.0004
IMPACT 2	6.29	-7.41	67.59	.2884
IMPACT 3	8.33	.31	31.61	.0051
IMPACT 4 (REVERSE)	8.19	-.20	33.05	.0040

TAPE CHANNEL 10 : VERTICAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.49	.14	13.64	.0011
IMPACT 2	6.29	-.15	12.87	.0012
IMPACT 3	8.33	.47	13.50	.0037
IMPACT 4 (REVERSE)	8.19	.76	15.13	.0065

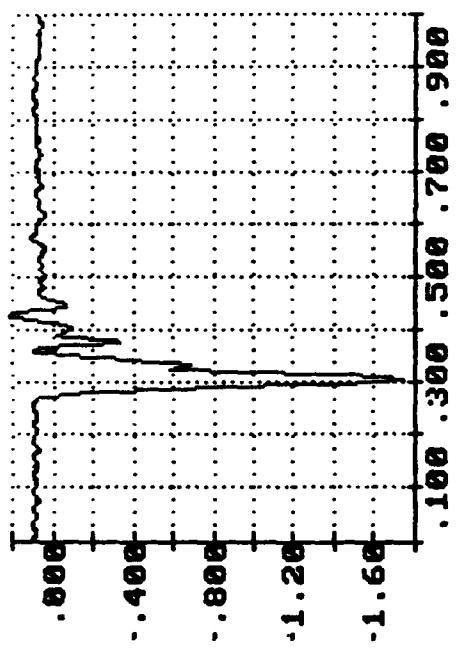
TAPE CHANNEL 12 : LONGITUDINAL ACCELERATION ON BOXCAR FLOOR

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.49	-.78	48.68	.0252
IMPACT 2	6.29	-3.16	24.83	.0491
IMPACT 3	8.33	-4.38	22.67	.0698
IMPACT 4 (REVERSE)	8.19	-4.33	37.67	.0921

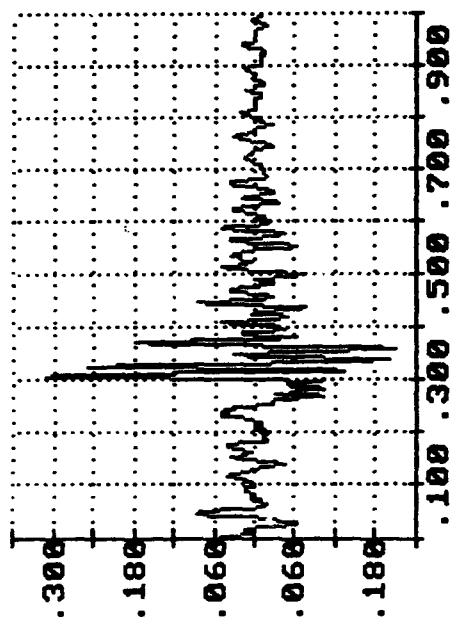
TAPE CHANNEL 14 : VERTICAL ACCELERATION ON BOXCAR FLOOR

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.49	-.21	12.06	.0000
IMPACT 2	6.29	-.63	23.06	.0007
IMPACT 3	8.33	.87	5.12	.0011
IMPACT 4 (REVERSE)	8.19	1.55	6.82	.0053

RAIL IMPACT TEST OF ATACMS IN BOXCAR  
DATE: 11 JULY 1989  
SPEED: 4.49 MPH

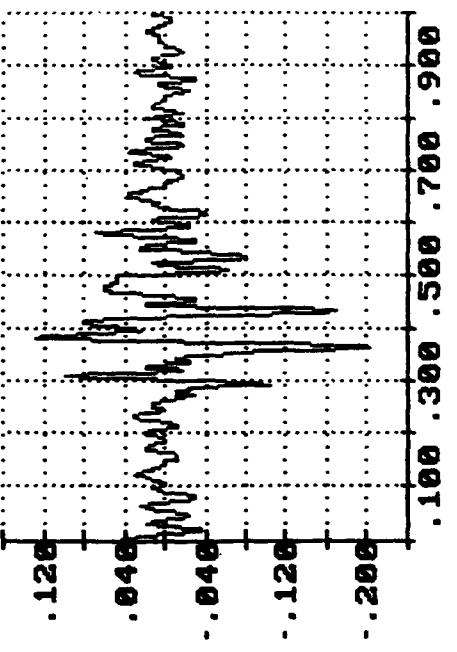


LATERAL ACCELERATION -  
ATTION FORWARD BLOCK  
ON FORWARD BLOCK  
IN G.S X 1.0000



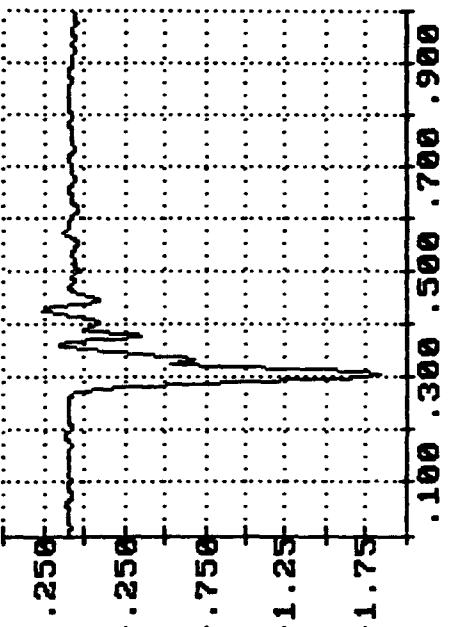
VERTICAL ACCELERATION -  
N ON FORWARD BLOCK  
IN G.S X 1.0000

Sample Time in Seconds  
X 1.0000



LATERAL ACCELERATION -  
ON FORWARD BLOCK  
IN FORWARD BLOCK  
IN G.S X 1.0000

Sample Time in Seconds  
X 1.0000



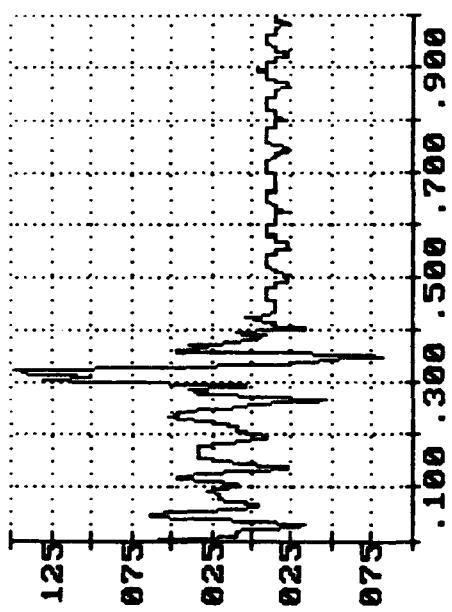
LONGITUDINAL ACCELER-  
ATION ON MIDDLE BLOCK  
IN G.S X 1.0000

Sample Time in Seconds  
X 1.0000

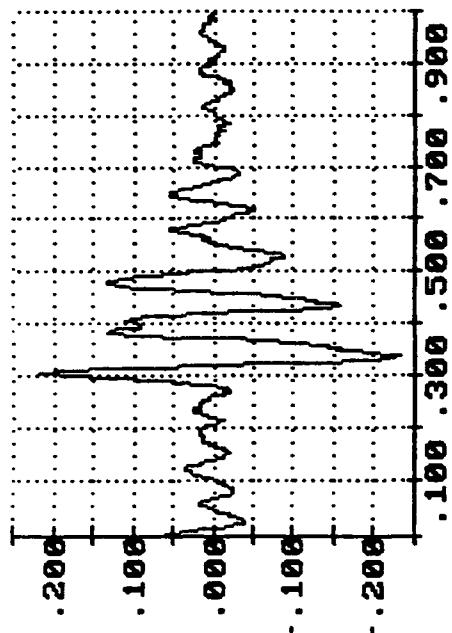
Sample Time in Seconds  
X 1.0000

Sample Time in Seconds  
X 1.0000

RAIL IMPACT TEST OF ATTACHS IN BOXCAR  
DATE: 11 JULY 1989  
SPEED: 4.49 MPH

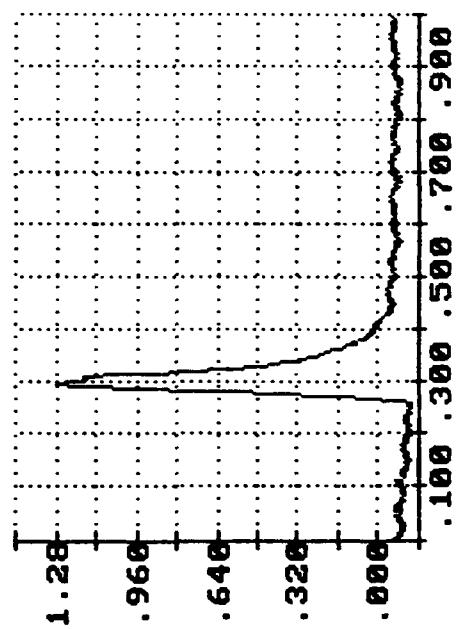


RAIL COUPLER FORCE  
MIDDLE BLOCK  
LATERAL ACCELERATION  
IN POUNDS X 1000000.0000

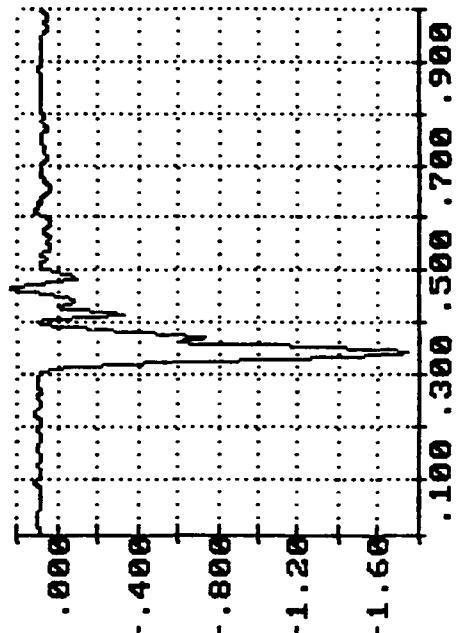


LATERAL ACCELERATION  
MIDDLE BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000



RAIL COUPLER FORCE  
MIDDLE BLOCK  
LATERAL ACCELERATION  
IN POUNDS X 1000000.0000



LONGITUDINAL ACCELERATION  
MIDDLE BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000

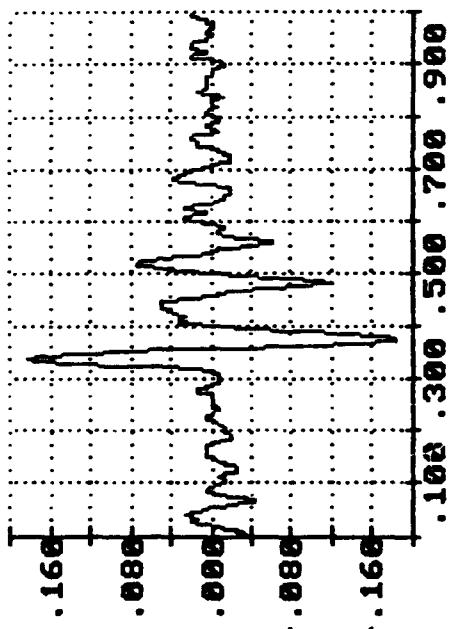


VERTICAL ACCELERATION  
MIDDLE BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000

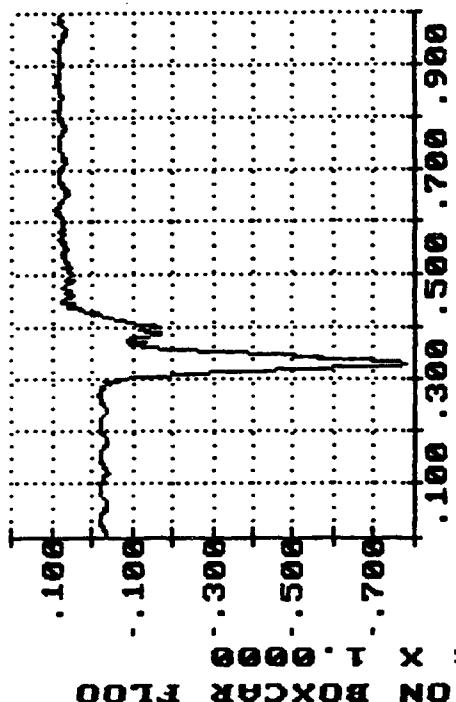
X 1.0000

RAIL IMPACT TEST OF ATTACHES IN BOXCAR  
DATE: 11 JULY 1989  
SPEED: 4.49 MPH



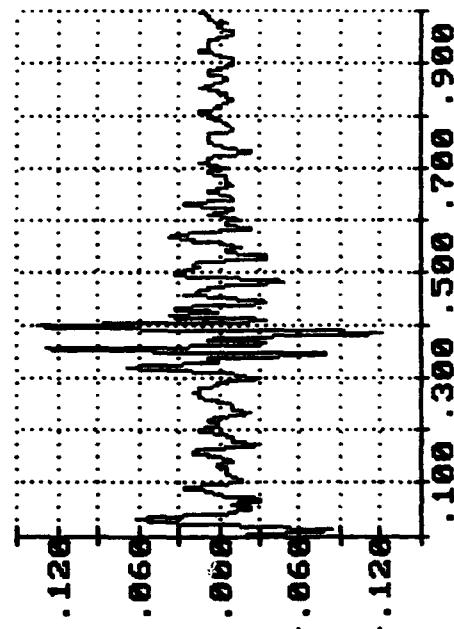
IN G'S X 1.0000  
ON REAR BLOCK  
LATERAL ACCELERATION -

Sample Time in Seconds  
x 1.0000



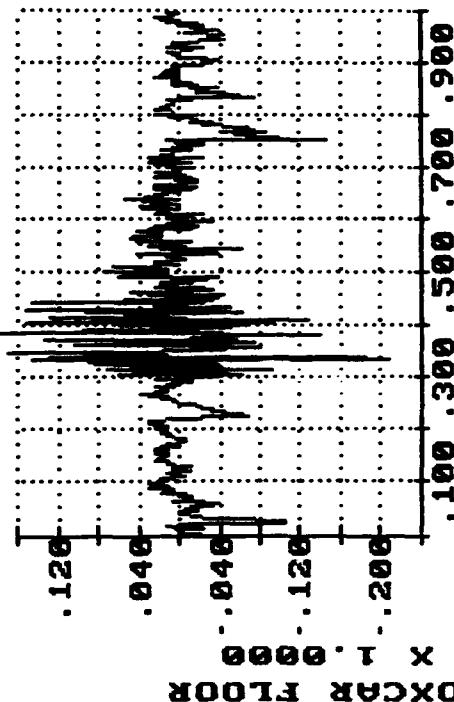
IN G'S X 1.0000  
ACTION ON BOXCAR FLOOR  
LONGITUDINAL ACCELERATION -

Sample Time in Seconds  
x 1.0000



IN G'S X 1.0000  
ON REAR BLOCK  
VERTICAL ACCELERATION -

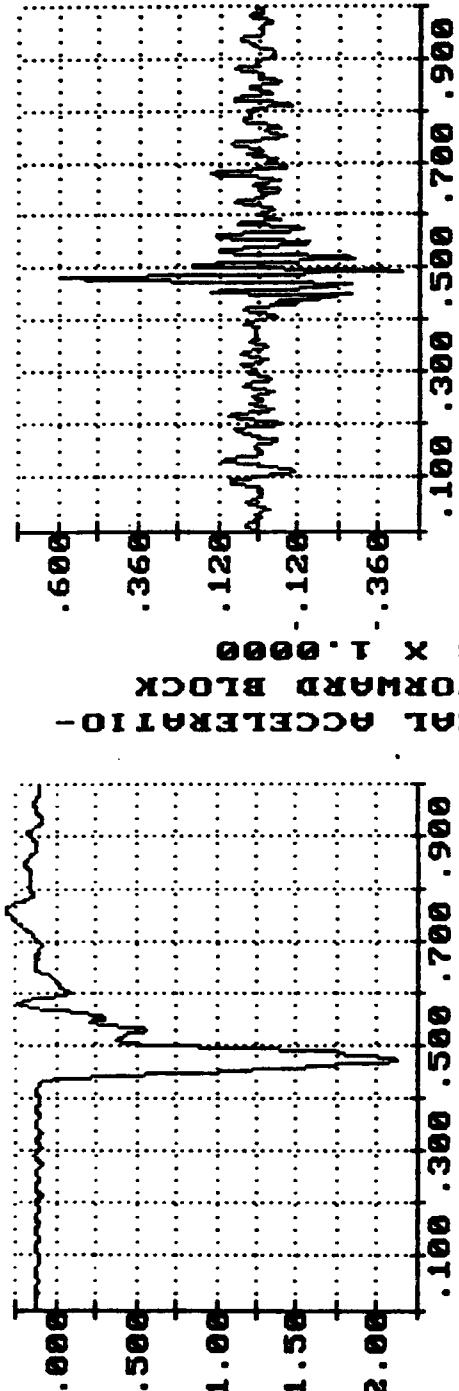
Sample Time in Seconds  
x 1.0000



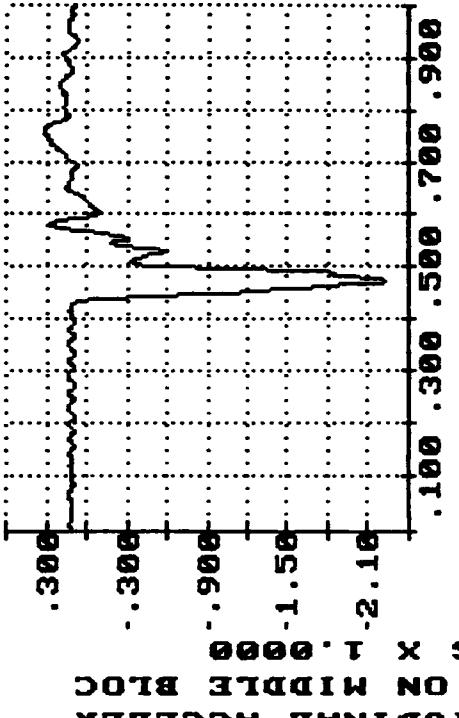
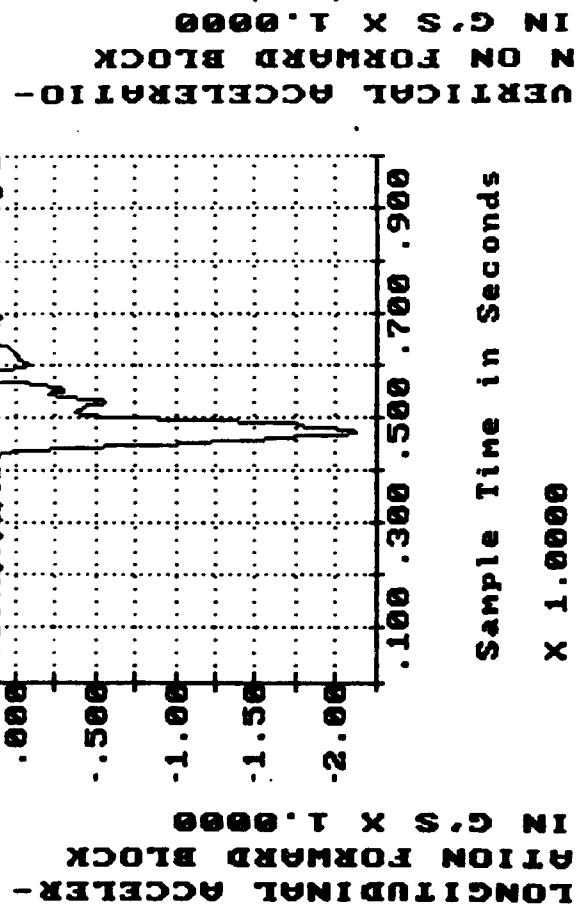
IN G'S X 1.0000  
IN BOXCAR FLOOR  
VERTICAL ACCELERATION -

Sample Time in Seconds  
x 1.0000

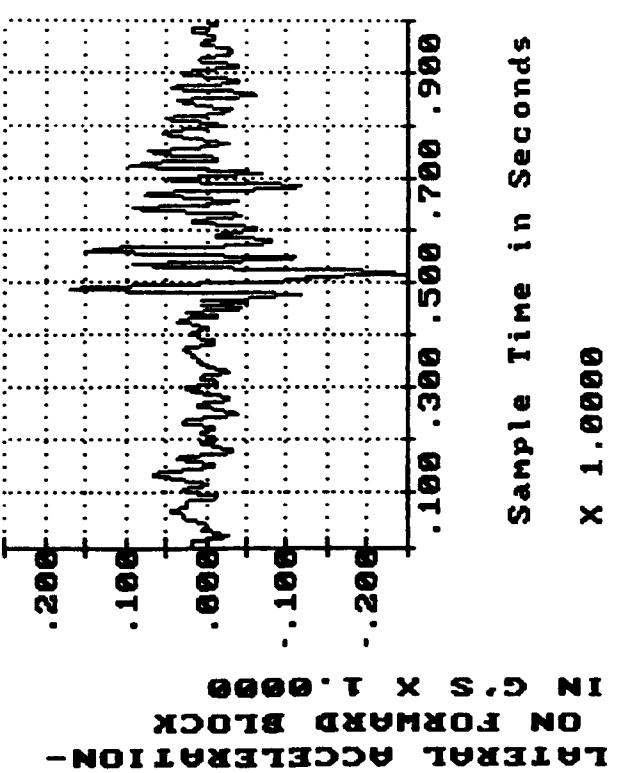
RAIL IMPACT TEST OF ATACMS IN BOXCAR  
DATE: 11 JULY 1989  
SPEED: 8.33 MPH



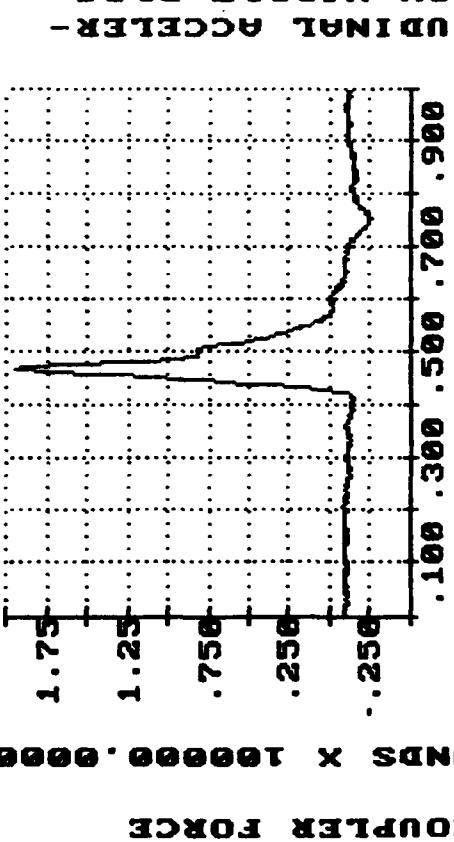
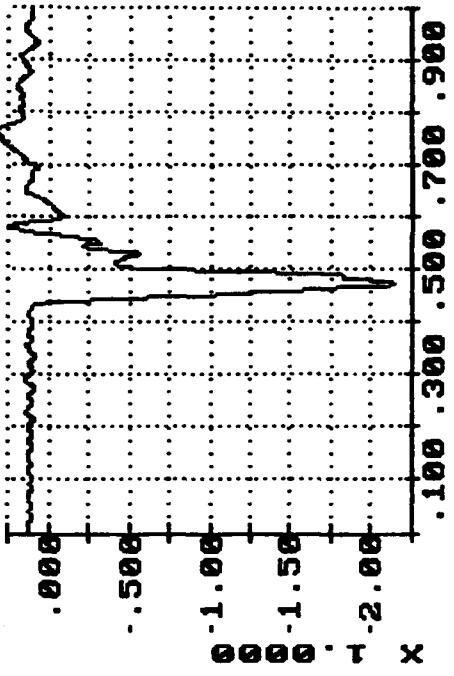
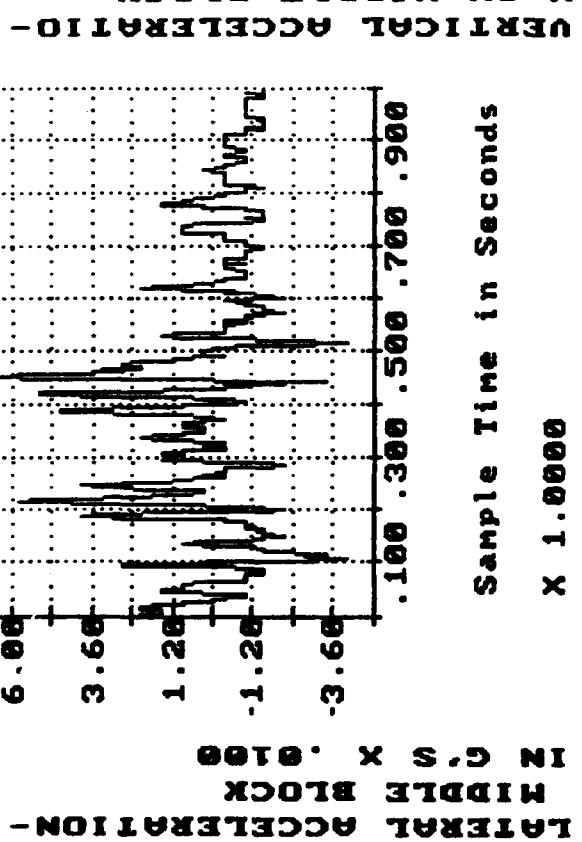
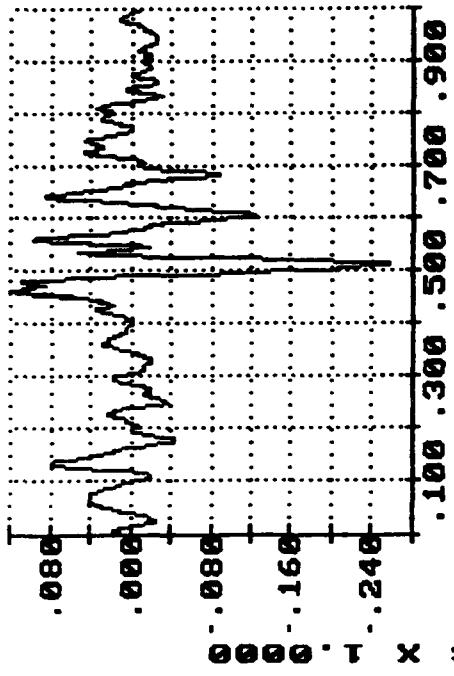
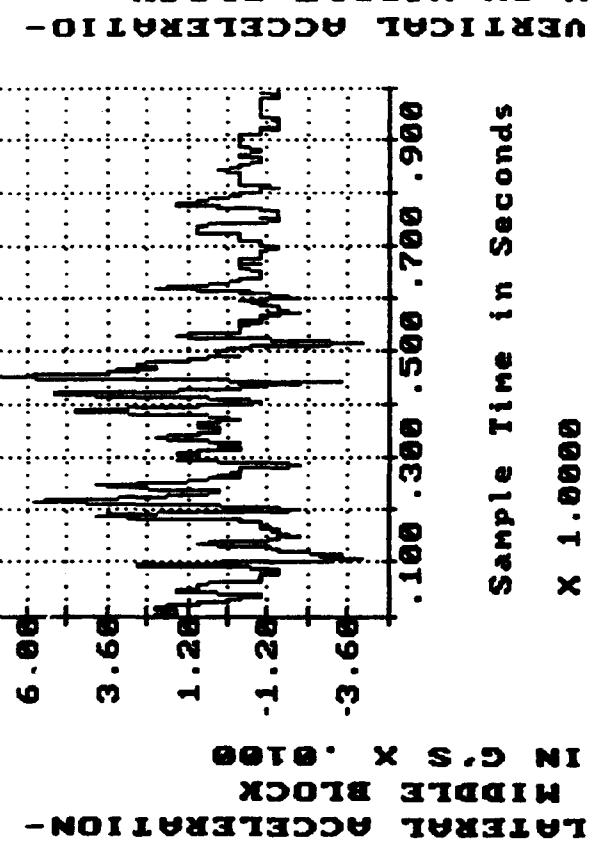
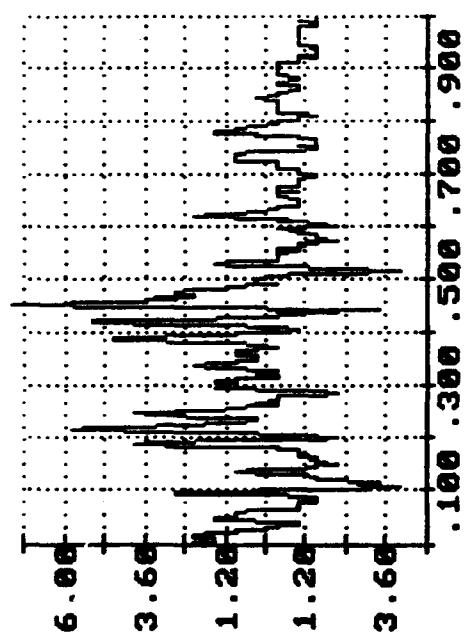
Sample Time in Seconds  
X 1.0000



Sample Time in Seconds  
X 1.0000



RAIL IMPACT TEST OF 45ACMS IN BOXCAR  
DATE: 11 JULY 1989  
SPEED: 8.33 MPH

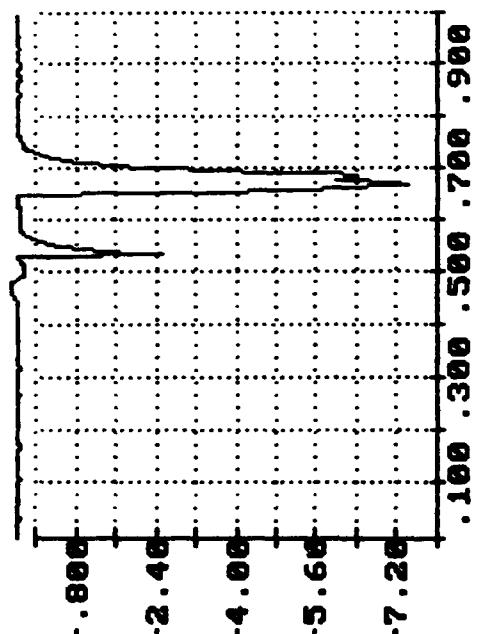


RAIL COUPLER FORCE  
IN POUNDS X 100000.0000 IN G.S X .0100  
MIDDLE BLOCK  
LATERAL ACCELERATION  
IN G.S X 1.00000  
LONGITUDINAL ACCELER-  
ATION ON MIDDLE BLOCK  
IN G.S X 1.00000  
VERTICAL ACCELERATION  
IN G.S X 1.00000  
ON MIDDLE BLOCK

RAIL IMPACT TEST OF ATTACMS IN BOXCAR

DATE: 11 July 1989

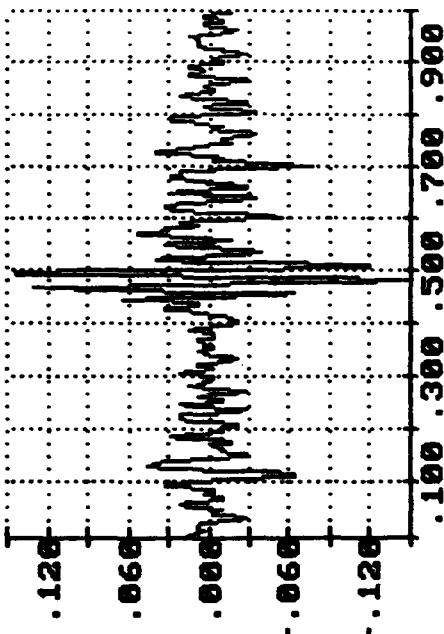
SPEED: 8.33 MPH



LATERAL ACCELERATION - ON REAR BLOCK

IN G.S X 1.0000

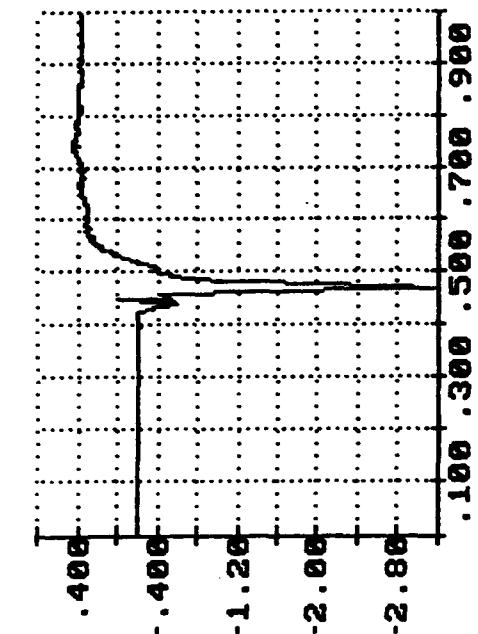
Sample Time in Seconds  
X 1.0000



VERTICAL ACCELERATION - ON REAR BLOCK

IN G.S X 1.0000

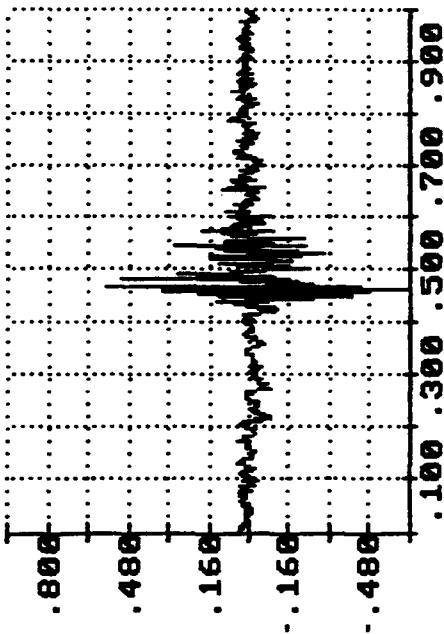
Sample Time in Seconds  
X 1.0000



LONGITUDINAL ACCELERATION -  
ACTION ON BOXCAR FLOOR

IN G.S X 1.0000

Sample Time in Seconds  
X 1.0000

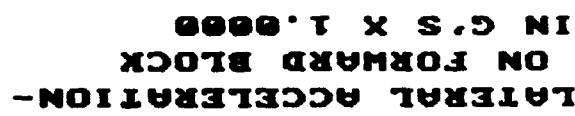
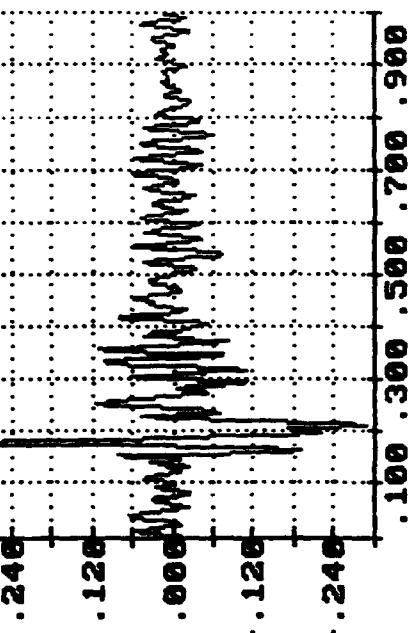
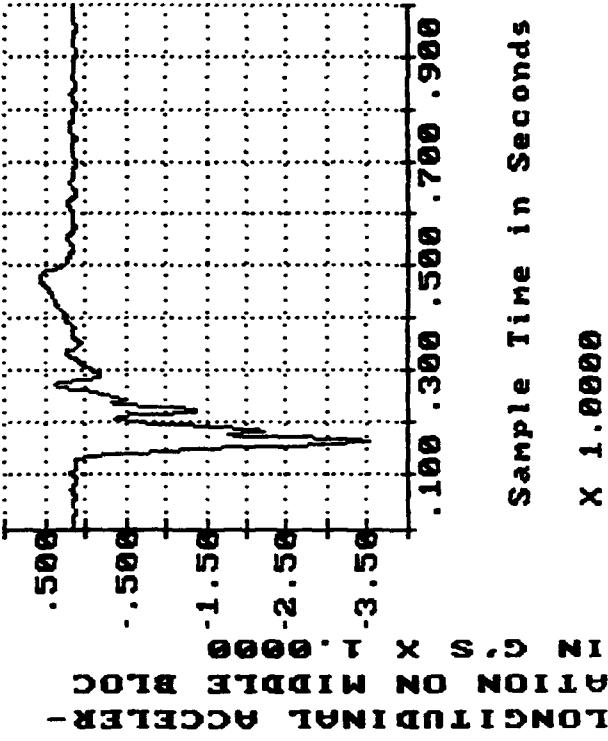
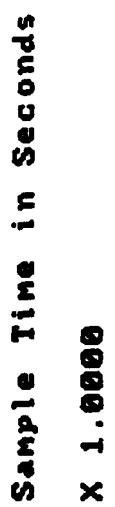
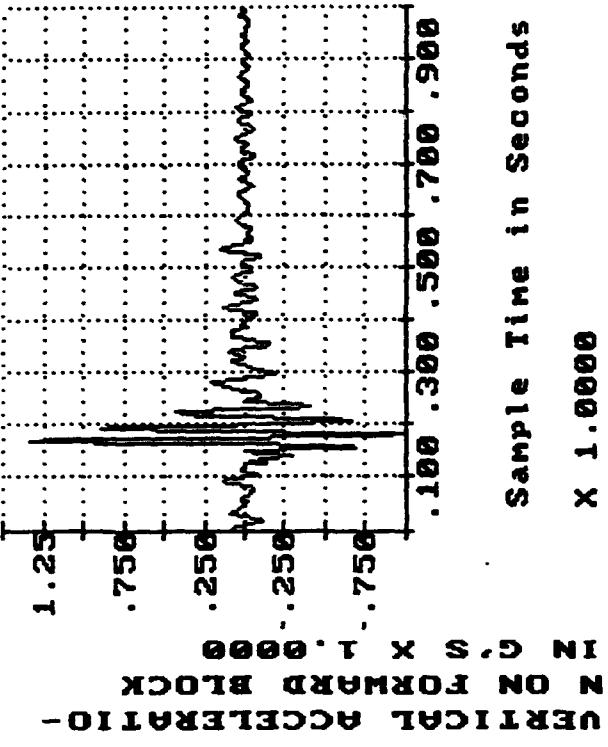
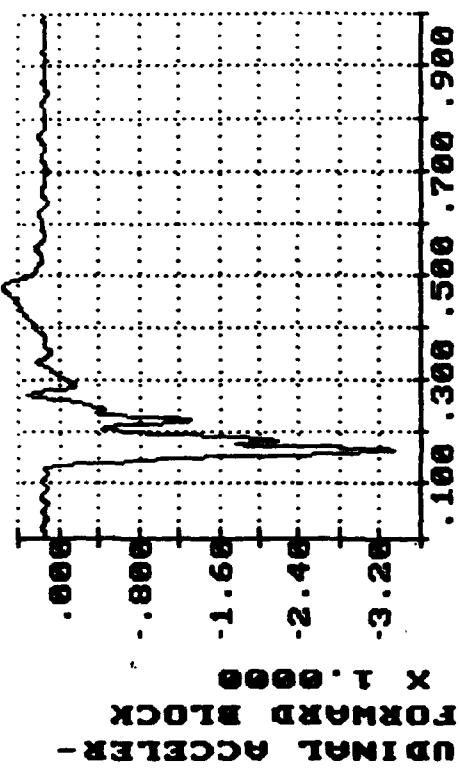


VERTICAL ACCELERATION - ON BOXCAR FLOOR

IN G.S X 1.0000

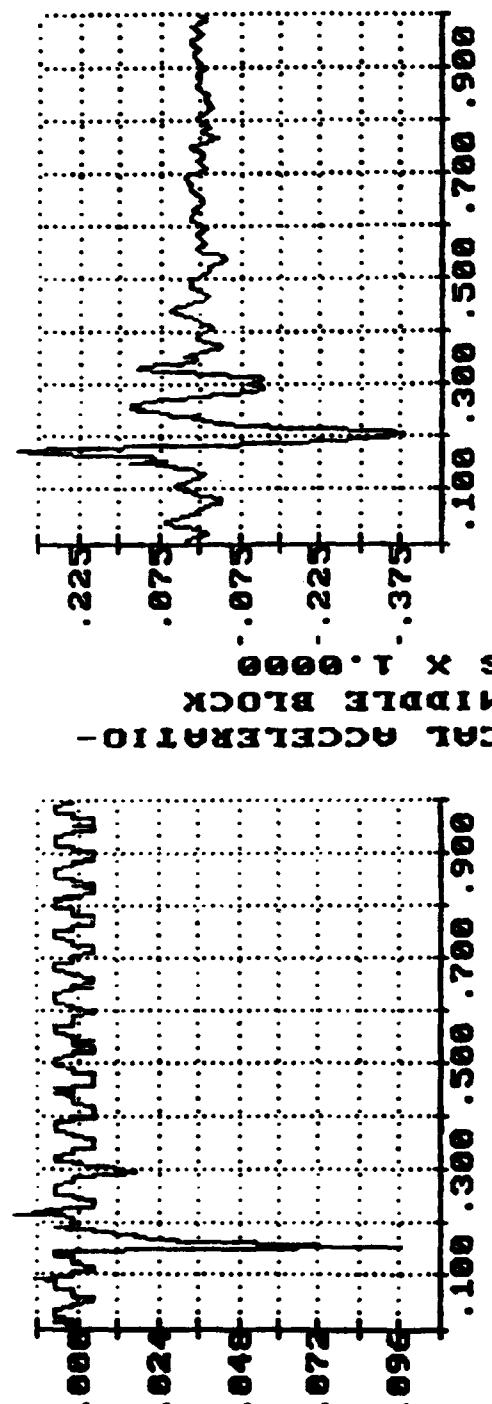
Sample Time in Seconds  
X 1.0000

RAIL IMPACT TEST OF ATTACHS IN BOXCAR  
DATE: 11 JULY 1989  
SPEED: 8.33 MPH



ROLL IMPACT TEST OF ATTACHES IN DUXCAR

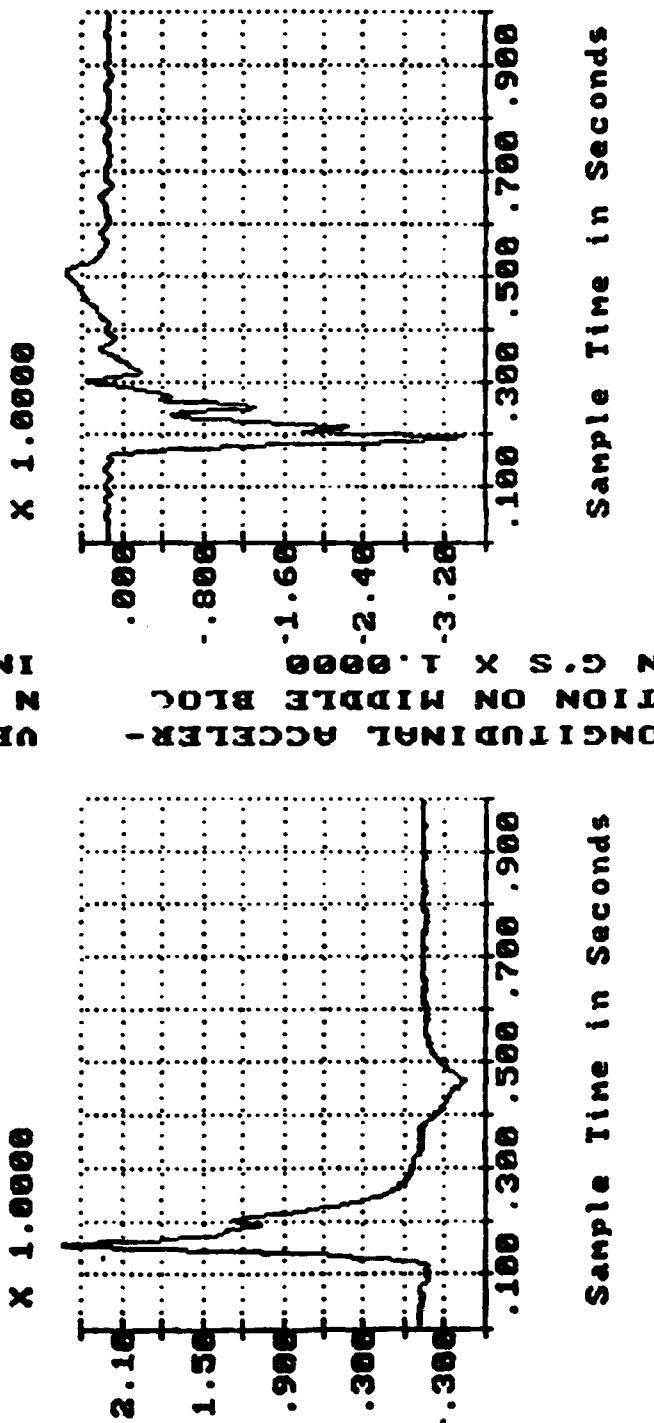
DATE: 11 JULY 1989  
SPEED: 8.33 MPH



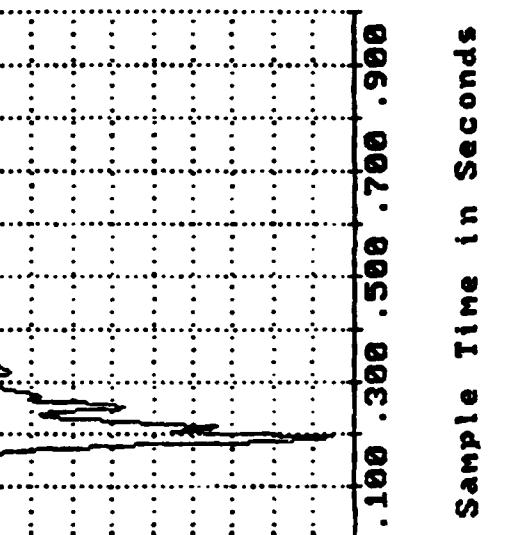
RAIL COUPLER FORCE  
LATERAL ACCELERATION - MIDDLE BLOCK  
IN POUNDS X 100000 .0000 IN G.S X 1.0000

Sample Time in Seconds  
x 1.0000

4-36

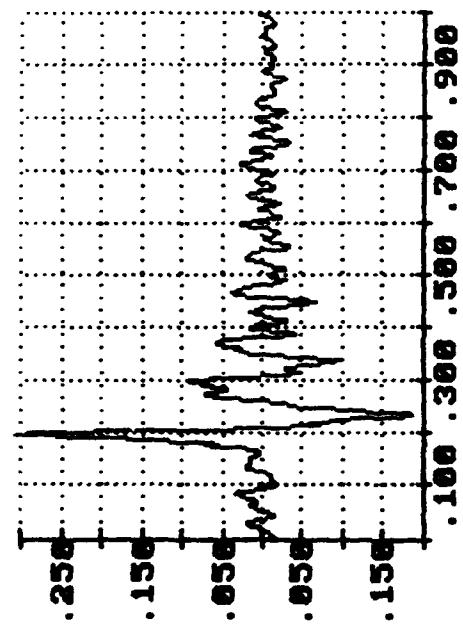


LONGITUDINAL ACCELERATION -  
MIDDLE BLOCK  
IN G.S X 1.0000



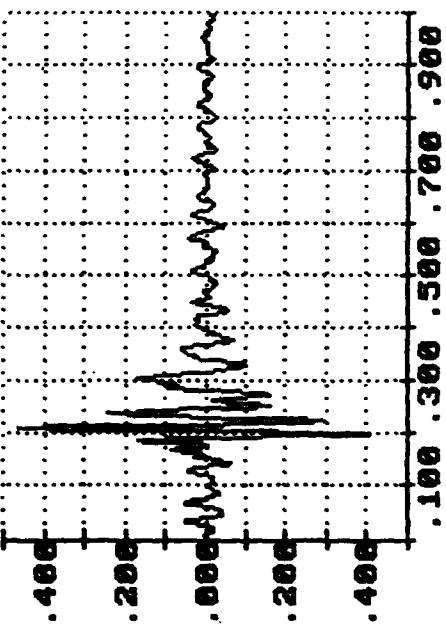
Sample Time in Seconds  
x 1.0000

RAIL IMPACT TEST OF ATTACHS IN BOXCAR  
DATE: 11 JULY 1989  
SPEED: 8.33 MPH



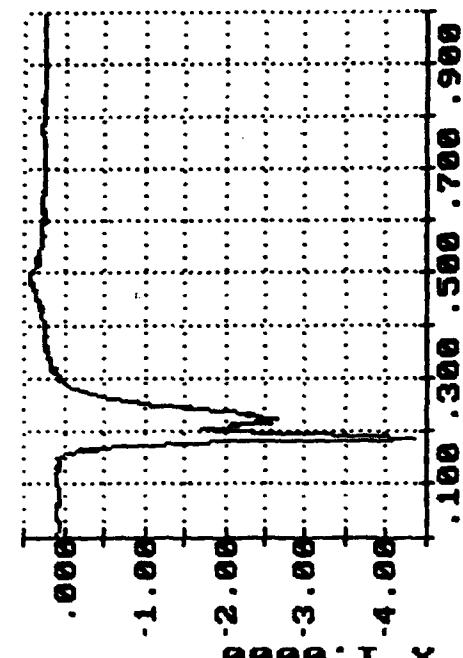
IN G'S X 1.0000  
ON REAR BLOCK  
LATERAL ACCELERATION -

Sample Time in Seconds  
X 1.0000



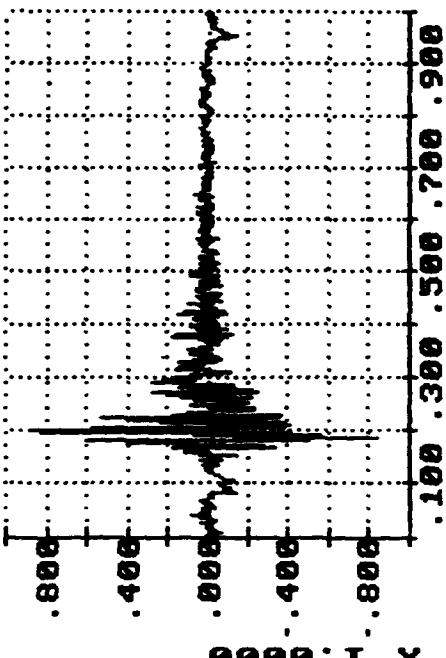
IN G'S X 1.0000  
ON REAR BLOCK  
VERTICAL ACCELERATION -

Sample Time in Seconds  
X 1.0000



IN G'S X 1.0000  
ATION ON BOXCAR FLOOR  
LONGITUDINAL ACCELER-

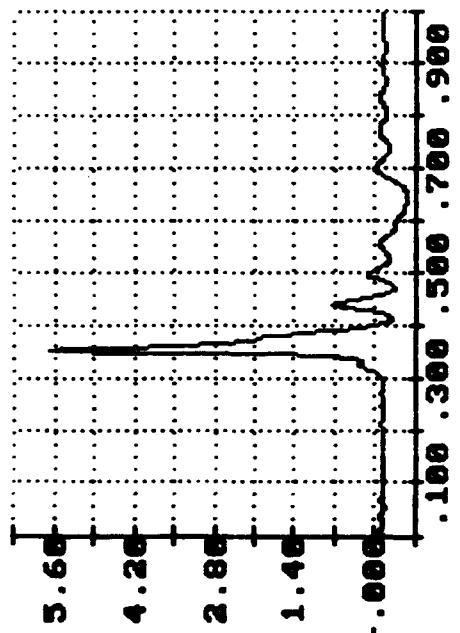
Sample Time in Seconds  
X 1.0000



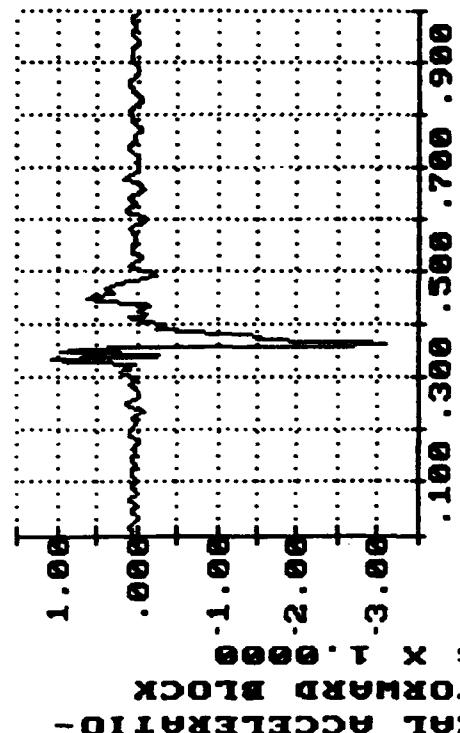
IN G'S X 1.0000  
ON BOXCAR FLOOR  
VERTICAL ACCELERATION -

Sample Time in Seconds  
X 1.0000

RAIL IMPACT TEST OF ATACMS IN BOXCAR  
DATE: 11 JULY 1989  
SPEED: 8.19 MPH (REVERSE)

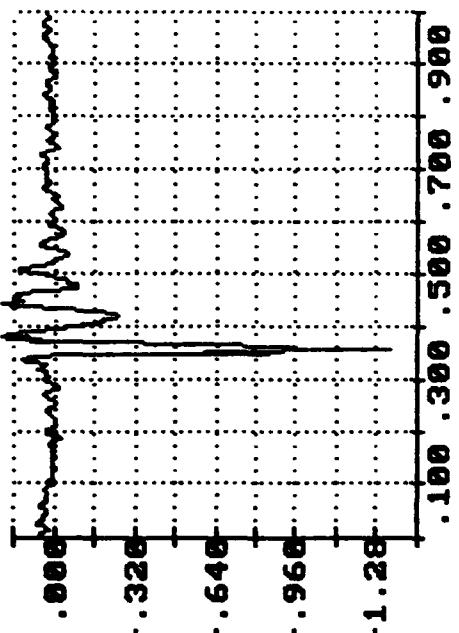


LONGITUDINAL ACCELERATION  
ATION ON FORWARD BLOCK  
IN G.S X 1.0000



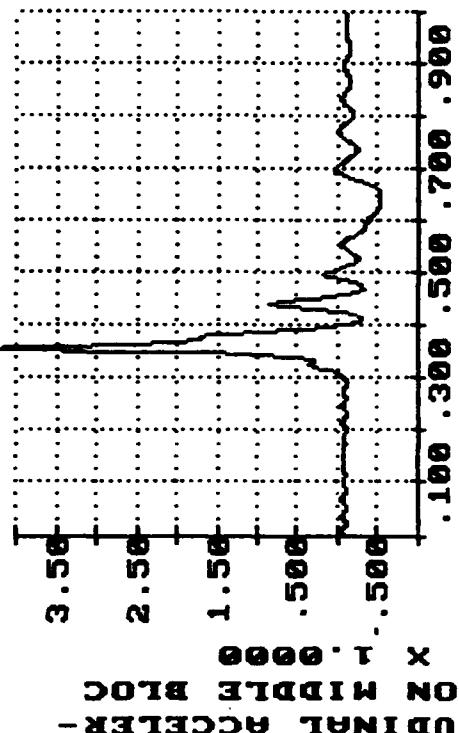
VERTICAL ACCELERATION  
N ON FORWARD BLOCK  
IN G.S X 1.0000

Sample Time in Seconds  
x 1.0000



LATERAL ACCELERATION  
ON FORWARD BLOCK  
IN G.S X 1.0000

Sample Time in Seconds  
x 1.0000

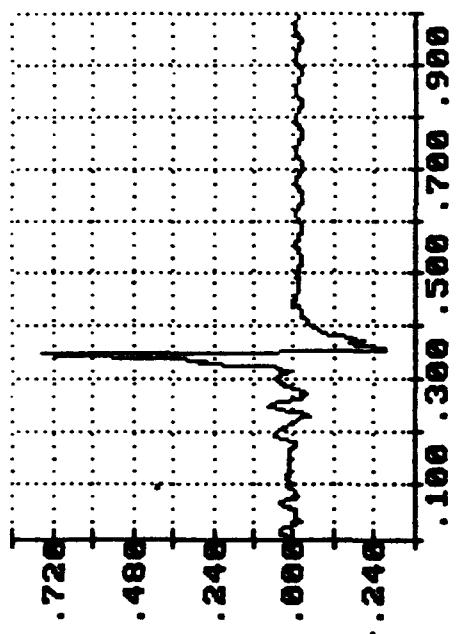


LONGITUDINAL ACCELERATION  
ATION ON MIDDLE BLOCK  
IN G.S X 1.0000

Sample Time in Seconds  
x 1.0000

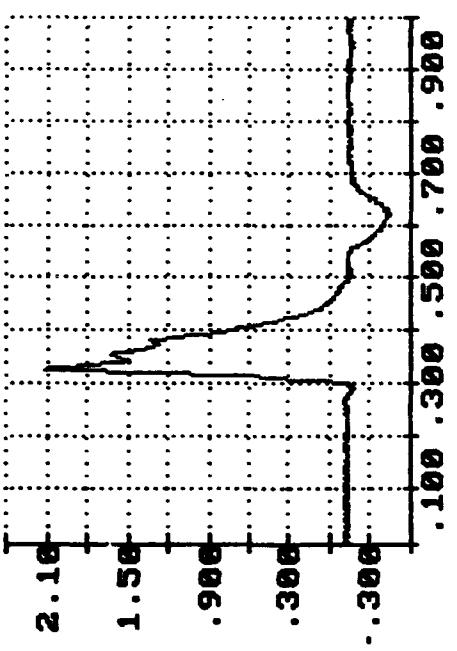
Sample Time in Seconds  
x 1.0000

RAIL IMPACT TEST OF ATTACHS IN BOXCAR  
DATE: 11 JULY 1989  
SPEED: 8.19 MPH (REVERSE)

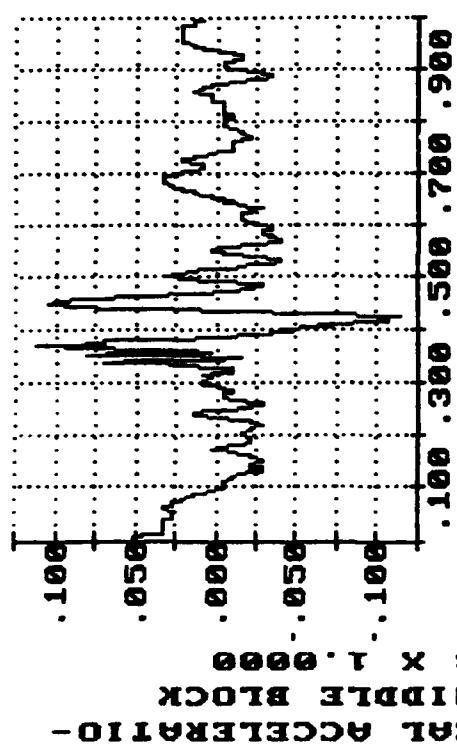


LATERAL ACCELERATION  
MIDDLE BLOCK  
IN POUNDS X 1000000.0000

Sample Time in Seconds  
X 1.0000

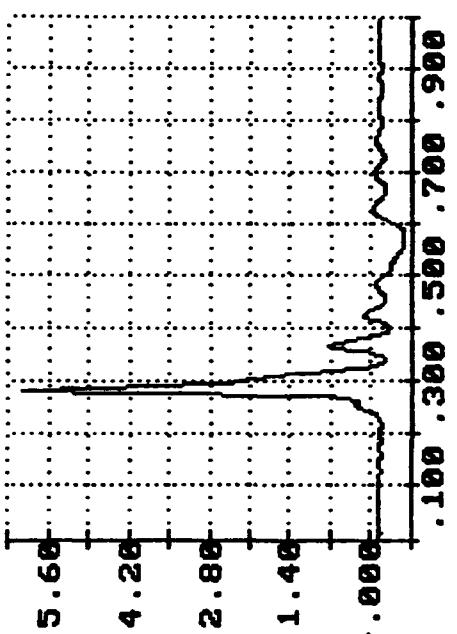


RAIL COUPLER FORCE  
MIDDLE BLOCK  
IN POUNDS X 1000000.0000



VERTICAL ACCELERATION  
MIDDLE BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000



LONGITUDINAL ACCELERATION  
MIDDLE BLOCK  
IN G'S X 1.0000

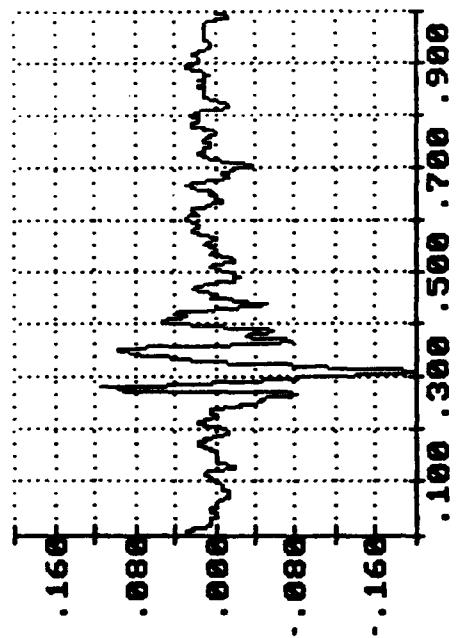
Sample Time in Seconds  
X 1.0000

Sample Time in Seconds  
X 1.0000

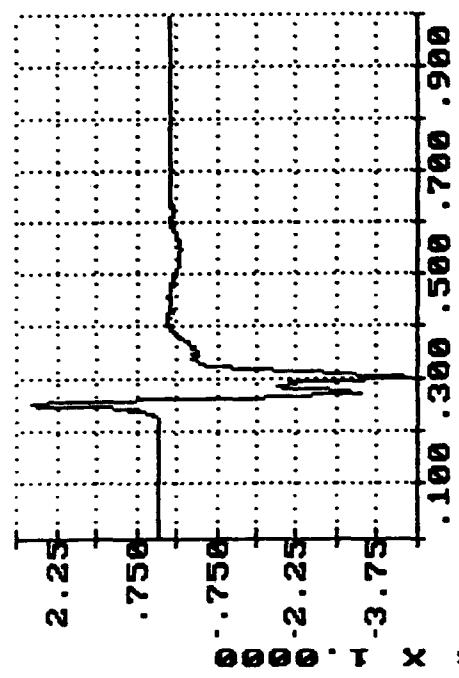
Sample Time in Seconds  
X 1.0000

RAIL IMPACT TESTS OF ATTACHES IN BOXCAR

DATE: 11 JULY 1989  
SPEED: 8.19 MPH (REVERSE)

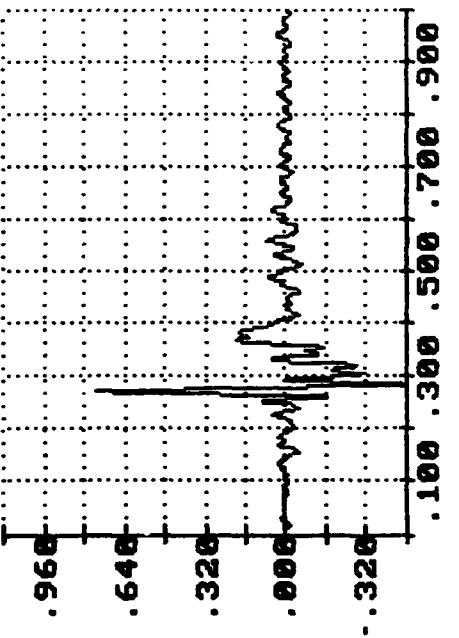


VERTICAL ACCELERATION -  
ON REAR BLOCK  
IN G'S X 1.0000

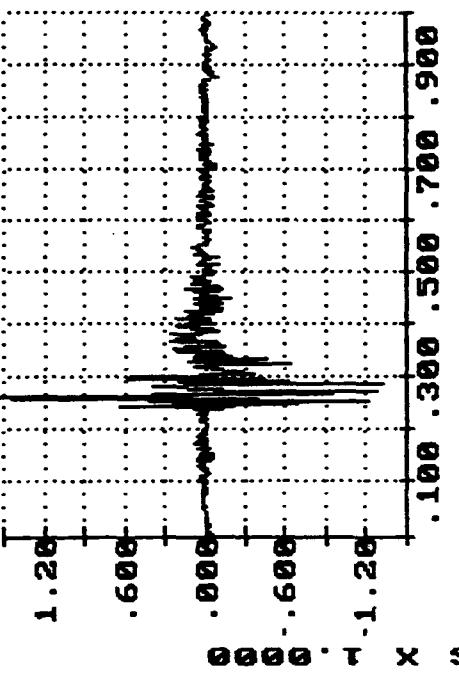


VERTICAL ACCELERATION -  
ON BOXCAR FLOOR  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000



VERTICAL ACCELERATION -  
ON REAR BLOCK  
IN G'S X 1.0000



Sample Time in Seconds  
X 1.0000

VERTICAL ACCELERATION -  
ON BOXCAR FLOOR  
IN G'S X 1.0000

## RAIL IMPACT TEST

TEST NO. 6

DATE: 12 JULY 1989

TEST SPECIMEN: ATACMS on LRP in MILVAN on TOFC.

TEST CAR NO: TTX 252005	LT. WT.	74,900	POUNDS	
MILVAN CHASSIS NO. 5394	LT. WT.	6,040	POUNDS	
MILVAN NO. 1058	LT. WT.	5,900	POUNDS	
LOAD AND ROLL PALLET NO.	LT. WT.	4,100	POUNDS	
LADING AND DUNNAGE	WT.	21,800	POUNDS	
	TOTAL SPECIMEN	WT.	112,740	POUNDS
	BUFFER CAR (5 CARS)	WT.	250,000	POUNDS
IMPACT NO.	END STRUCK	VELOCITY (MPH)	REMARKS	
1	Forward	4.09	End of pallet shifted 5/8 inch. Pallet rocked up about one inch.	
2	Forward	6.37	Additional 1/4-inch movement.	
3	Forward	8.23	Securing blocks tight.	
4	Reverse	8.54	No damage or shifting.	

RESULTS FROM RAIL IMPACT TESTING OF  
ATACMS IN TOFC  
DATE: 12 JULY 1989

TAPE CHANNEL 1 : LONGITUDINAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.09	1.41	80.79	.0786
IMPACT 2	6.37	2.00	98.41	.1199
IMPACT 3	8.23	2.81	183.99	.1928
IMPACT 4 (REVERSE)	8.54	-3.45	106.72	.2326

TAPE CHANNEL 2 : LATERAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.09	.18	35.55	.0033
IMPACT 2	6.37	.19	24.90	.0030
IMPACT 3	8.23	.25	17.79	.0025
IMPACT 4 (REVERSE)	8.54	-.35	25.02	.0050

TAPE CHANNEL 3 : VERTICAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.09	.96	56.23	.0352
IMPACT 2	6.37	1.15	26.26	.0191
IMPACT 3	8.23	1.66	151.43	.0925
IMPACT 4 (REVERSE)	8.54	-1.56	60.24	.0323

TAPE CHANNEL 4 : LONGITUDINAL ACCELERATION ON MIDDLE BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.09	1.44	81.64	.0802
IMPACT 2	6.37	2.11	87.76	.1175
IMPACT 3	8.23	2.96	129.99	.1981
IMPACT 4 (REVERSE)	8.54	-3.31	110.56	.2323

TAPE CHANNEL 5 : LATERAL ACCELERATION ON MIDDLE BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.09	.57	51.27	.0196
IMPACT 2	6.37	.38	30.91	.0078
IMPACT 3	8.23	.04	26.09	.0009
IMPACT 4 (REVERSE)	8.54	.03	16.78	.0004

TAPE CHANNEL 6 : RAIL COUPLER FORCE

TEST	SPEED MPH	PEAK VALUE POUNDS	DURATION MILLISECONDS	AREA POUNDS-SECONDS
IMPACT 1	4.09	121160.75	76.81	5496.80
IMPACT 2	6.37	169545.41	48.85	5707.44
IMPACT 3	8.23	232486.73	42.93	6658.96
IMPACT 4 (REVERSE)	8.54	207655.44	44.05	6140.35

TAPE CHANNEL 7 : VERTICAL ACCELERATION ON MIDDLE BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.09	-.14	42.40	.0039
IMPACT 2	6.37	.22	36.00	.0052
IMPACT 3	8.23	.23	86.93	.0114
IMPACT 4 (REVERSE)	8.54	.24	26.72	.0047

TAPE CHANNEL 8 : LONGITUDINAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.09	1.39	83.03	.0791
IMPACT 2	6.37	2.02	102.76	.1212
IMPACT 3	8.23	2.86	137.24	.1968
IMPACT 4 (REVERSE)	8.54	-3.45	109.06	.2335

TAPE CHANNEL 9 : LATERAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.09	-.11	26.65	.0019
IMPACT 2	6.37	.16	79.76	.0046
IMPACT 3	8.23	-11.93	38.24	.2926
IMPACT 4 (REVERSE)	8.54	.20	26.08	.0031

TAPE CHANNEL 10 : VERTICAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.09	.37	61.37	.0091
IMPACT 2	6.37	.62	37.45	.0141
IMPACT 3	8.23	.72	28.24	.0146
IMPACT 4 (REVERSE)	8.54	1.60	26.02	.0259

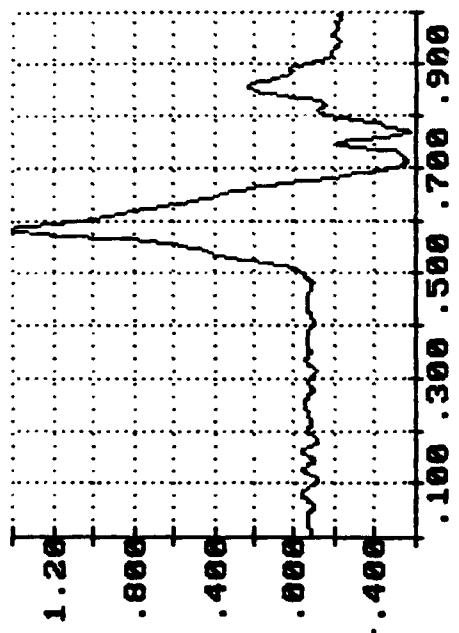
TAPE CHANNEL 12 : LONGITUDINAL ACCELERATION ON BOXCAR FLOOR

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.09	-1.47	126.23	.0732
IMPACT 2	6.37	-4.10	60.39	.1100
IMPACT 3	8.23	-2.20	37.11	.0485
IMPACT 4 (REVERSE)	8.54	1.36	23.09	.0180

TAPE CHANNEL 14 : VERTICAL ACCELERATION ON BOXCAR FLOOR

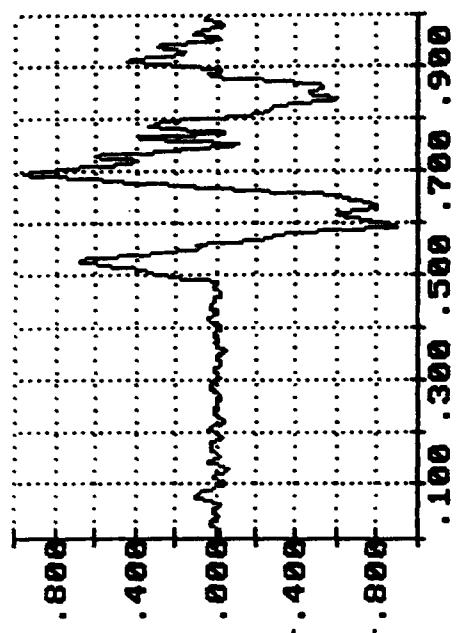
TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.09	.33	12.76	.0035
IMPACT 2	6.37	.57	30.37	.0125
IMPACT 3	8.23	-3.07	25.54	.0455
IMPACT 4 (REVERSE)	8.54	-1.01	9.24	.0054

RAIL IMPACT TEST OF ATTACHS ON TOFC  
DATE: 12 JULY 1989  
SPEED: 4.09 MPH



LONGITUDINAL ACCELERATION  
ON FORWARD BLOCK

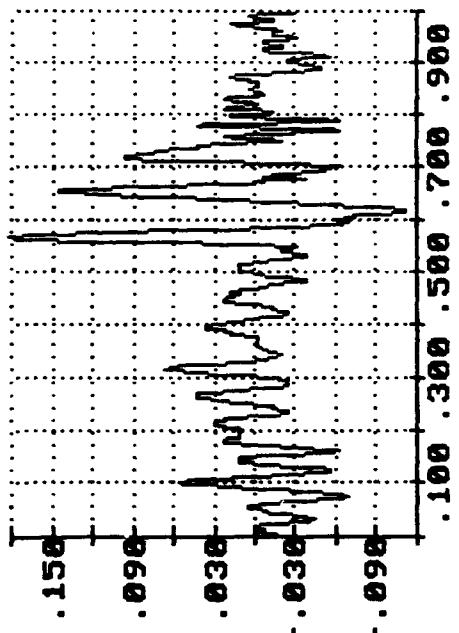
IN G'S X 1.0000



VERTICAL ACCELERATION  
ON FORWARD BLOCK

IN G'S X 1.0000

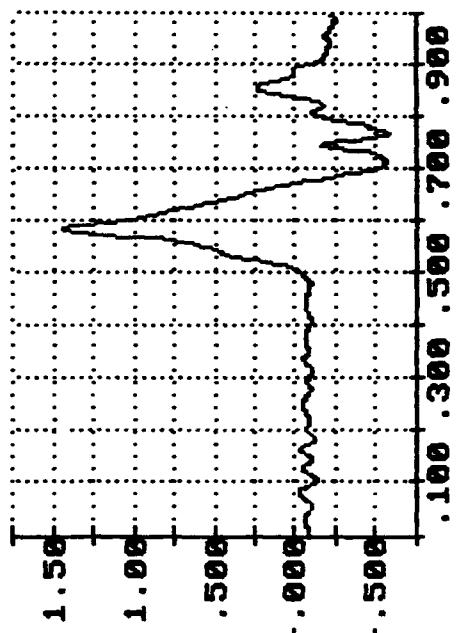
Sample Time in Seconds  
x 1.0000



LATERAL ACCELERATION  
ON FORWARD BLOCK  
IN G'S X 1.0000

-

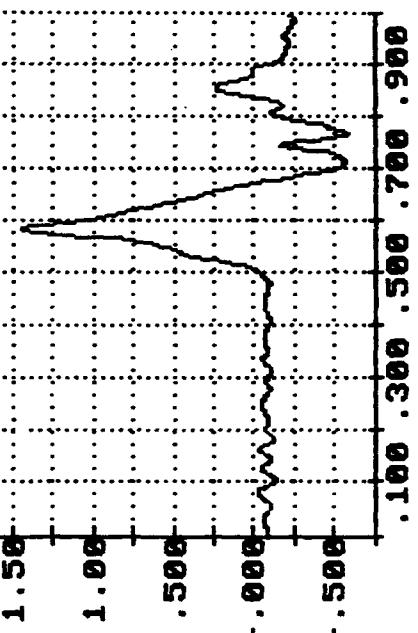
Sample Time in Seconds  
x 1.0000



LONGITUDINAL ACCELERATION  
ON MIDDLE BLOCK  
IN G'S X 1.0000

-

Sample Time in Seconds  
x 1.0000

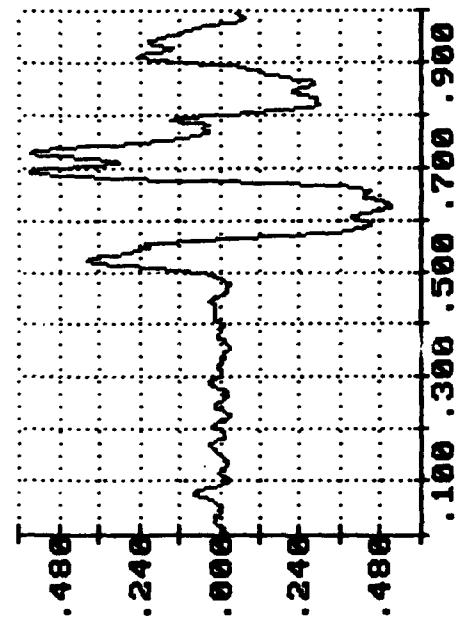


VERTICAL ACCELERATION  
ON MIDDLE BLOCK  
IN G'S X 1.0000

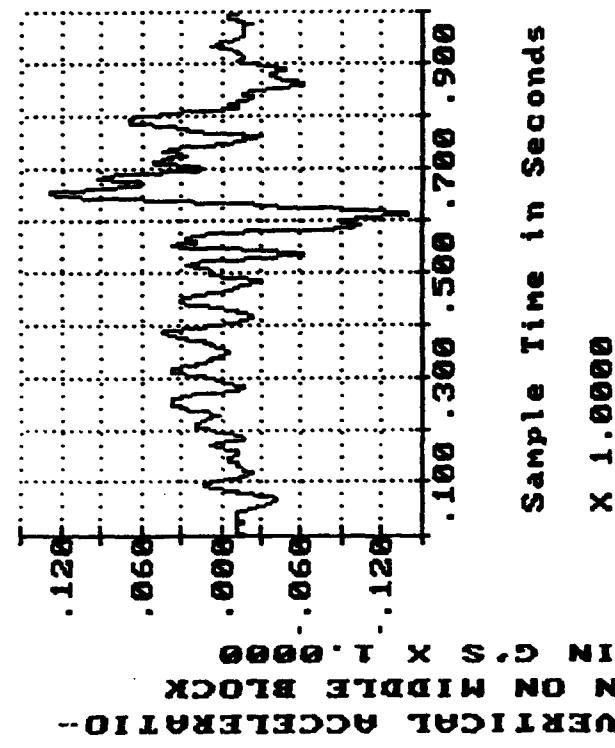
-

Sample Time in Seconds  
x 1.0000

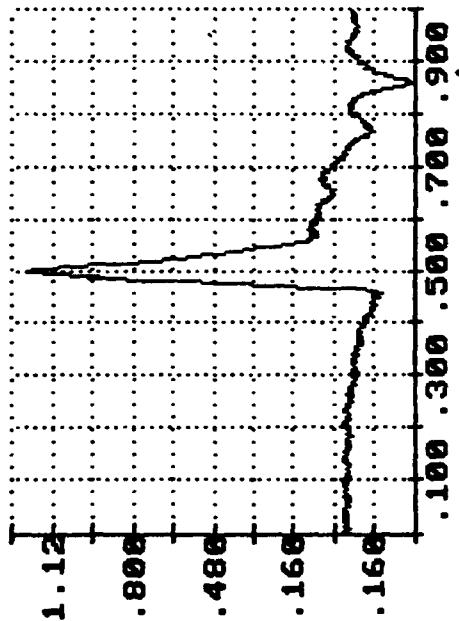
RAIL IMPACT TEST OF ATTACHS ON TUFC  
DATE: 12 JULY 1989  
SPEED: 4.09 MPH



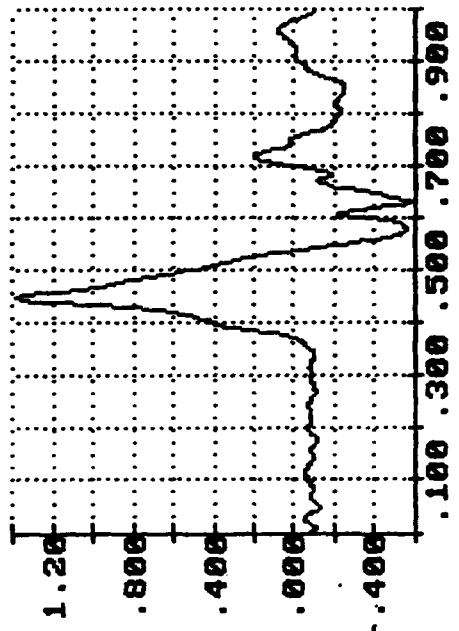
LATERAL ACCELERATION - ON MIDDLE BLOCK IN POUNDS X 1000000.0000 IN G.S X 1.0000  
RAIL COUPLER FORCE



VERTICAL ACCELERATION - ON MIDDLE BLOCK IN G.S X 1.0000  
LONGITUDINAL ACCELERER -

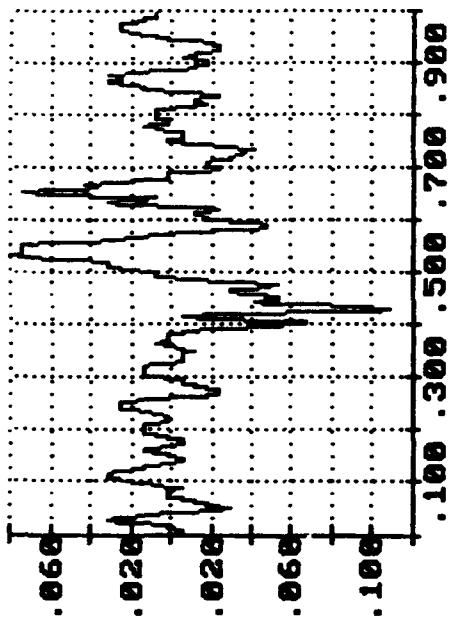


Sample Time in Seconds  
X 1.0000  
LONGITUDINAL ACCELERER -  
SECTION ON MIDDLE BLOCK IN G.S X 1.0000  
Sample Time in Seconds  
X 1.0000

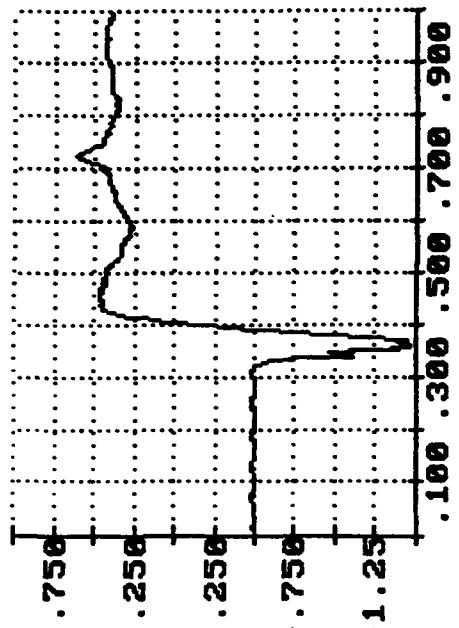


LONGITUDINAL ACCELERER -  
SECTION ON MIDDLE BLOCK IN G.S X 1.0000  
Sample Time in Seconds  
X 1.0000

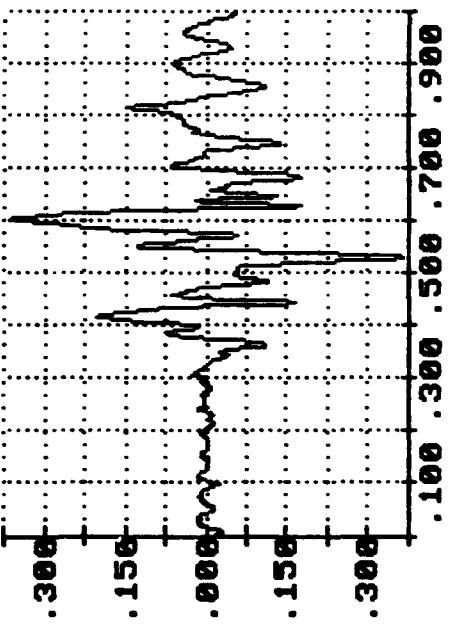
RAIL IMPACT TEST OF ATACMS ON TOFC  
DATE: 12 JULY 1989  
SPEED: 4.09 MPH



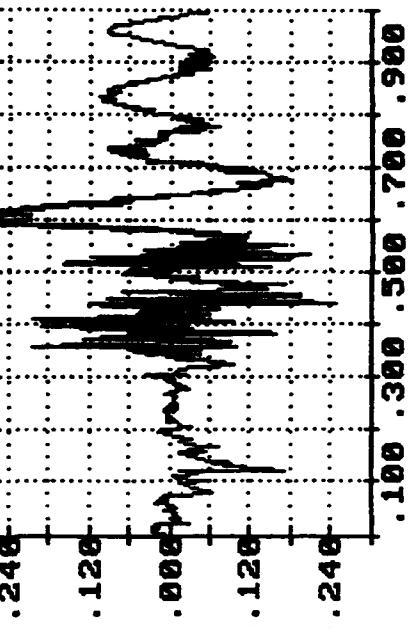
Sample Time in Seconds  
X 1.0000



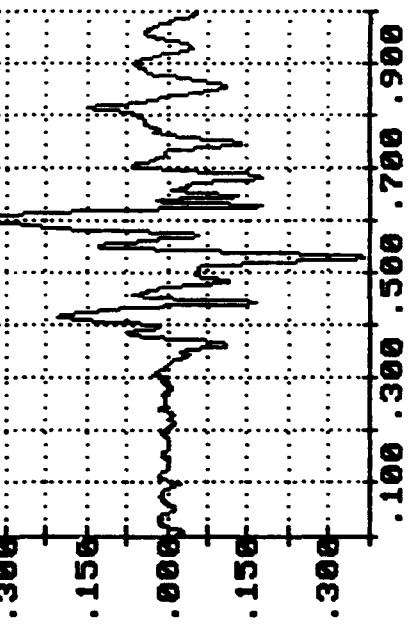
Sample Time in Seconds  
X 1.0000



Sample Time in Seconds  
X 1.0000

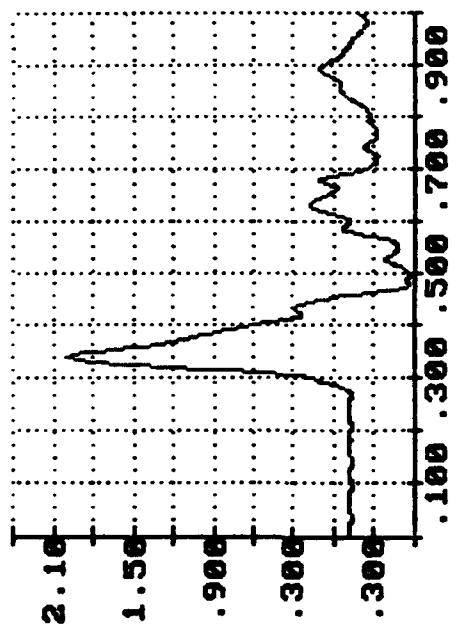


Sample Time in Seconds  
X 1.0000

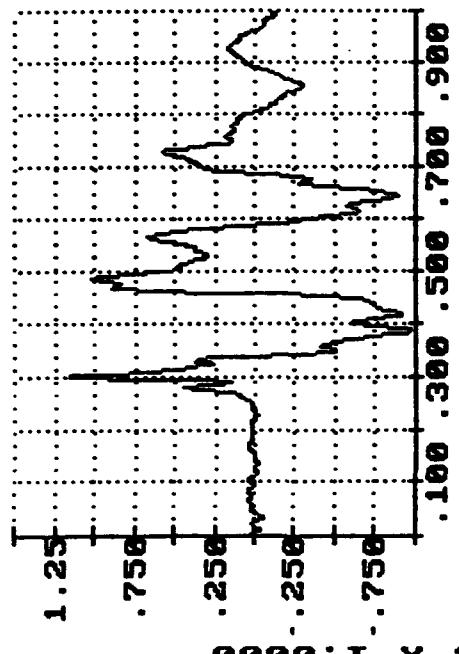


Sample Time in Seconds  
X 1.0000

RAIL IMPACT TEST OF ATTACMS ON TOFC  
DATE: 12 JULY 1989  
SPEED: 6.37 MPH

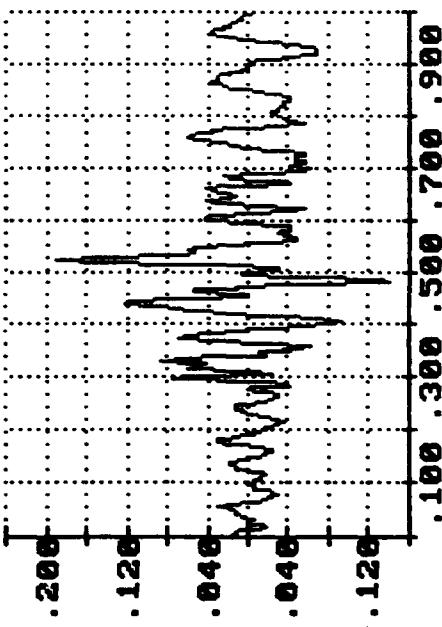


LONGITUDINAL ACCELERATION  
ATTION ON FORWARD BLOCK  
IN G'S X 1.0000

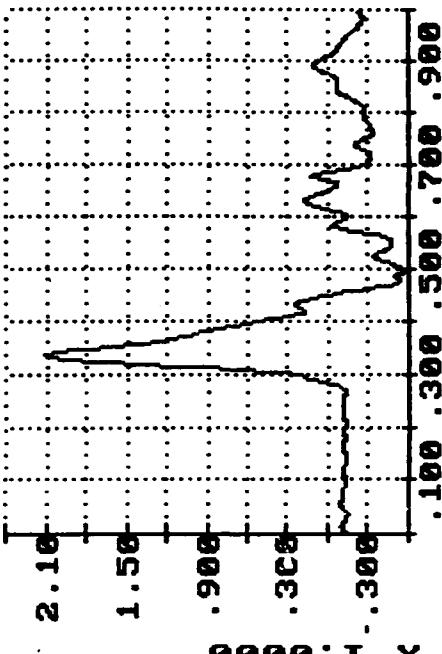


VERTICAL ACCELERATION  
IN ON FORWARD BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000



LATERAL ACCELERATION  
ON FORWARD BLOCK  
IN G'S X 1.0000



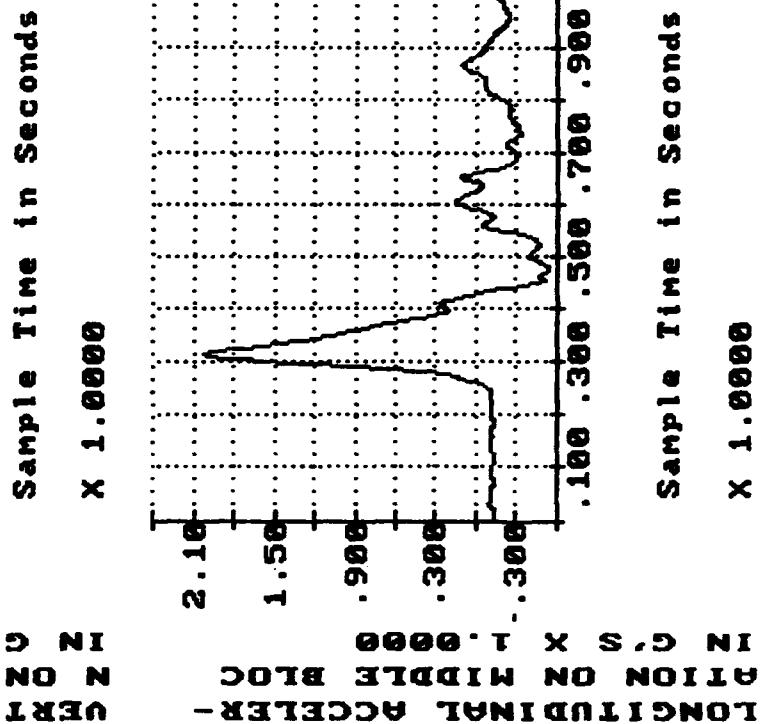
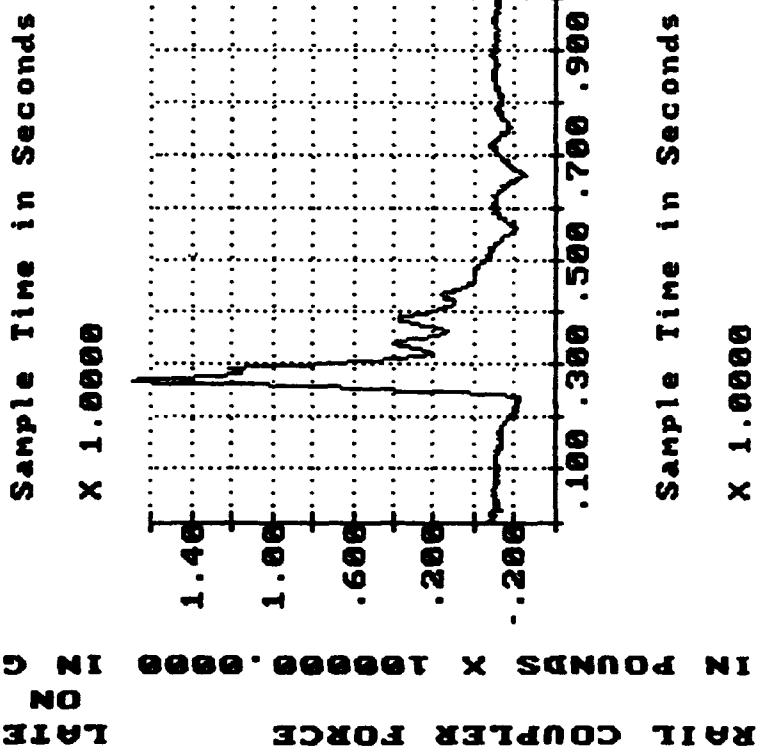
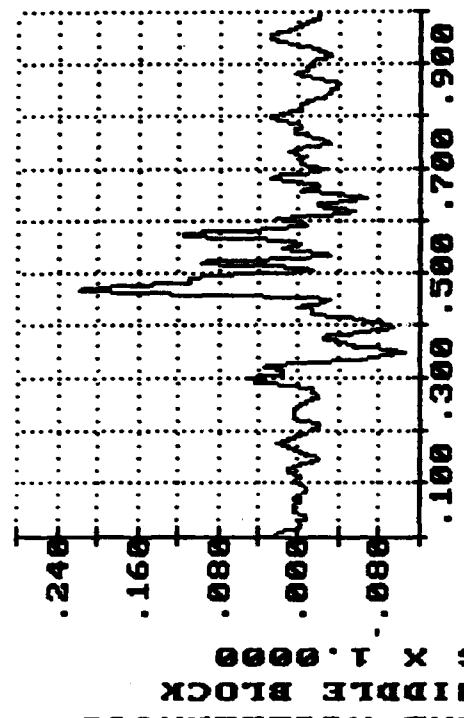
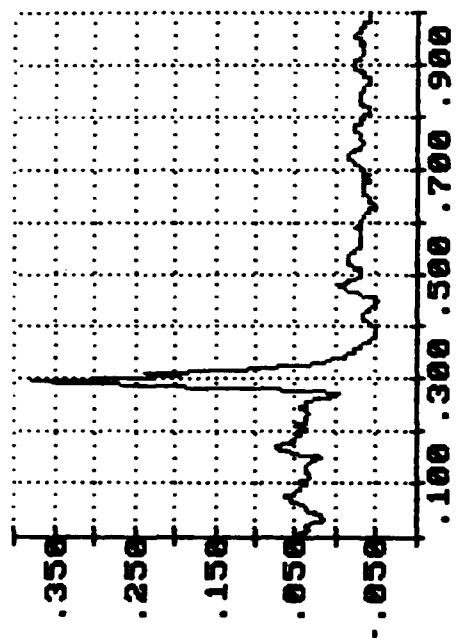
LONGITUDINAL ACCELER-  
ATION ON MIDDLE BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000

Sample Time in Seconds  
X 1.0000

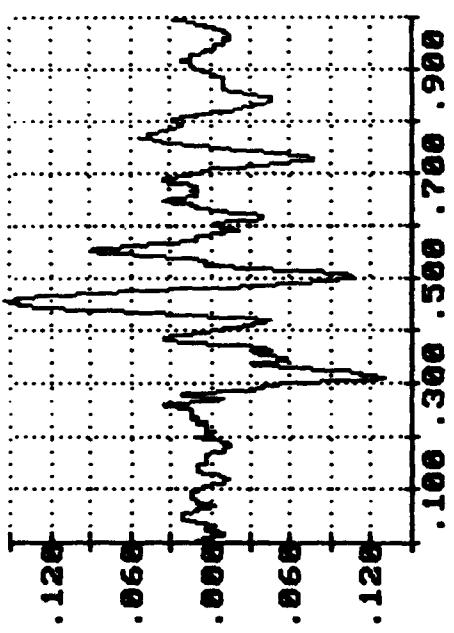
Sample Time in Seconds  
X 1.0000

RAIL IMPACT TEST OF ATTACMS ON 10FC  
DATE: 12 JULY 1989  
SPEED: 6.37 MPH

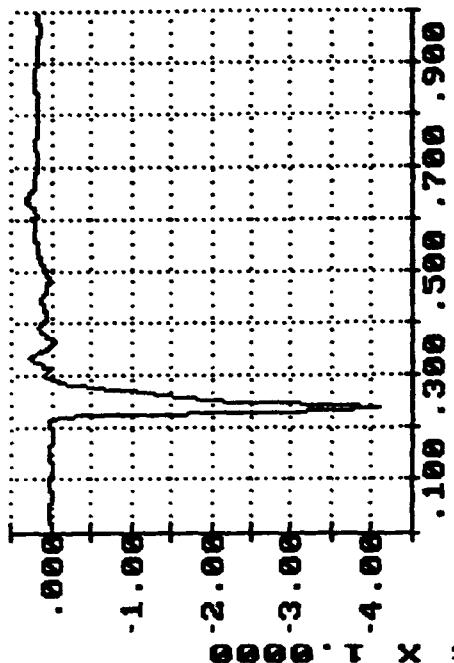


RAIL IMPACT TEST OF ATTACHES ON TOFC

DATE: 12 JULY 1989  
SPEED: 6.37 MPH



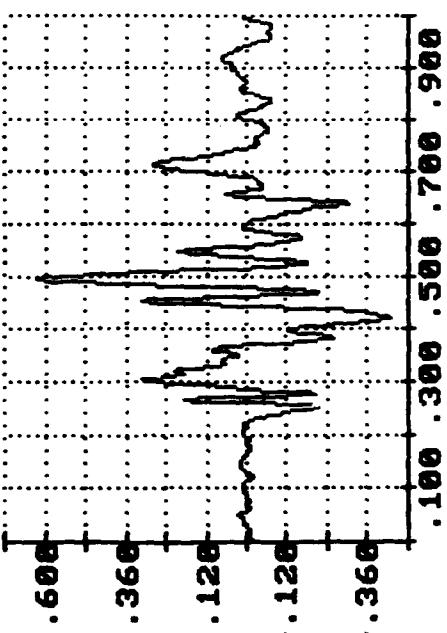
LATERAL ACCELERATION-  
ON REAR BLOCK  
IN G'S X 1.0000



LONGITUDINAL ACCELERATION-  
ACTION ON REAR BLOCK  
IN G'S X 1.0000

Sample Time in Seconds

Sample Time in Seconds



VERTICAL ACCELERATION-  
ON REAR BLOCK  
IN G'S X 1.0000

Sample Time in Seconds

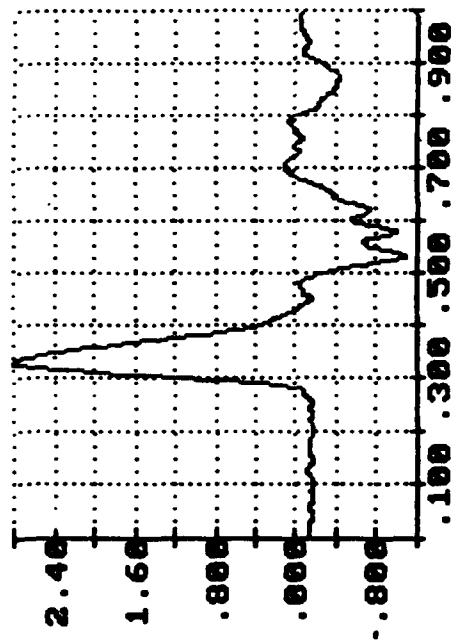
Sample Time in Seconds

VERTICAL ACCELERATION-  
ON BOXCAR FLOOR  
IN G'S X 1.0000

Sample Time in Seconds

Sample Time in Seconds

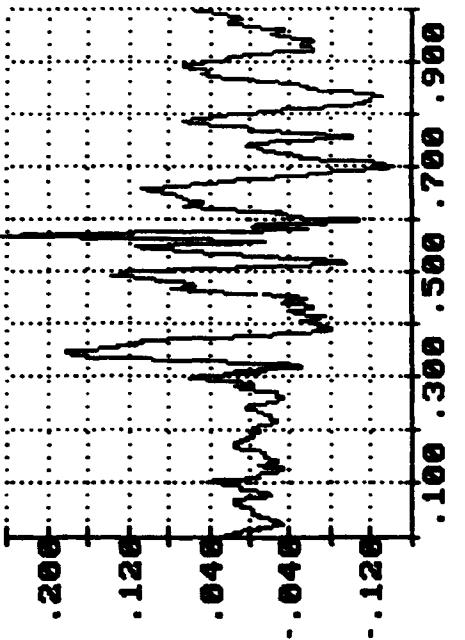
RAIL IMPACT TEST OF ATACS ON TOFC  
DATE: 12 JULY 1989  
SPEED: 8.23 MPH



LATERAL ACCELERATION -  
ON FORWARD BLOCK  
ATION ON FORWARD BLOCK

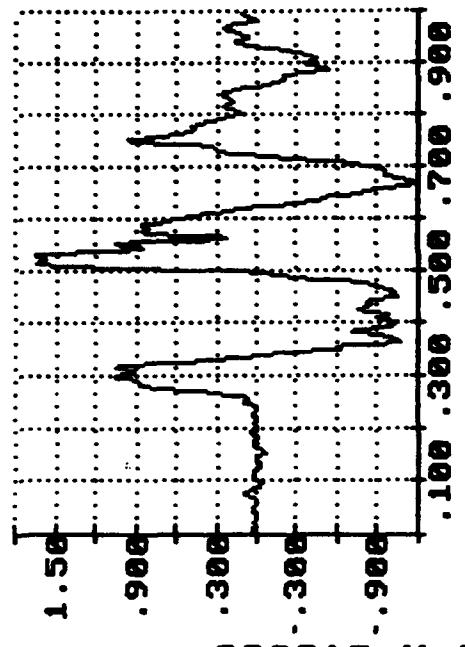
IN G'S X 1.0000  
LATERAL ACCELERATION -  
ON FORWARD BLOCK  
ATION ON FORWARD BLOCK

Sample Time in Seconds  
X 1.0000

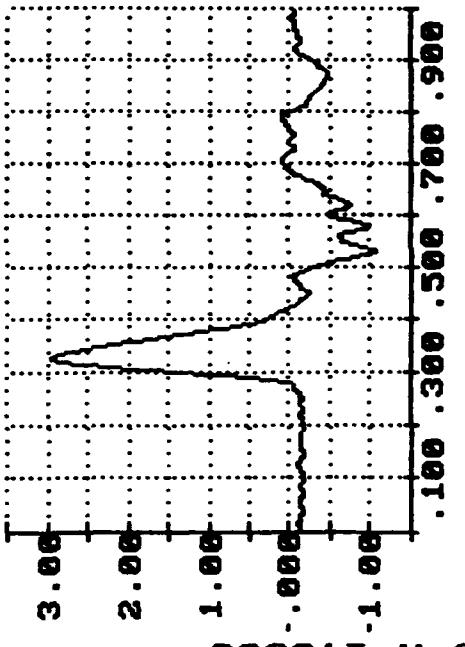


IN G'S X 1.0000  
LATERAL ACCELERATION -  
ON FORWARD BLOCK  
ATION ON FORWARD BLOCK

Sample Time in Seconds  
X 1.0000



VERTICAL ACCELERATION -  
ON FORWARD BLOCK  
ATION ON FORWARD BLOCK

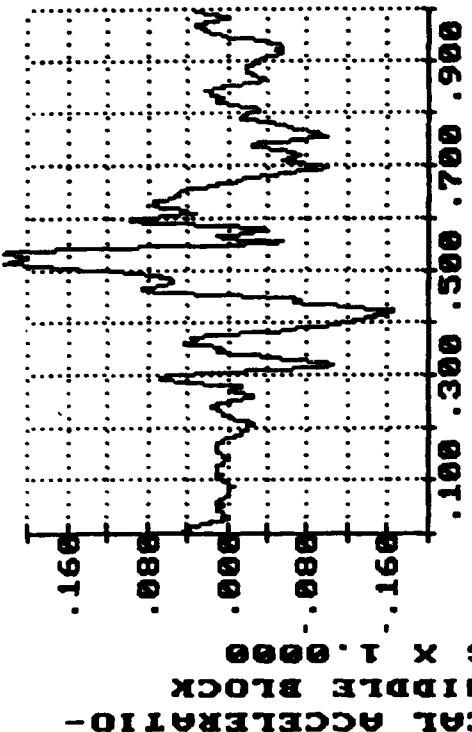
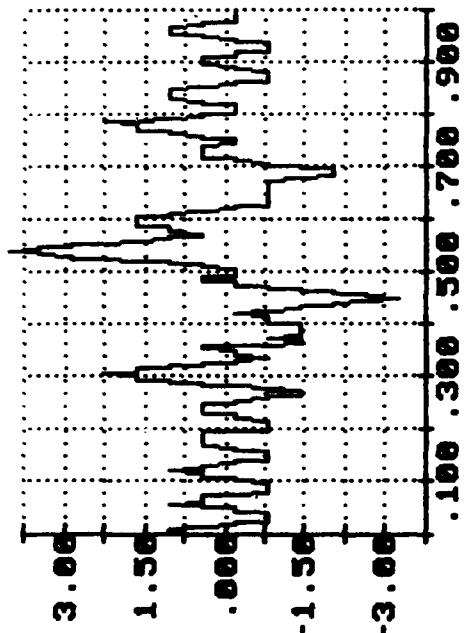


LONGITUDINAL ACCELERATION -  
ATION ON MIDDLE BLOCK  
IN G'S X 1.0000

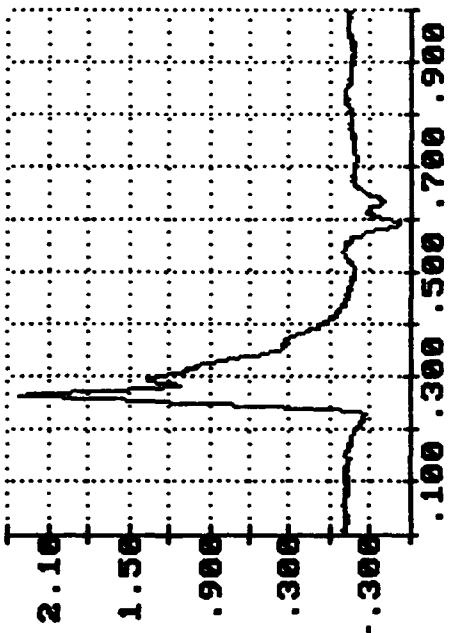
Sample Time in Seconds  
X 1.0000

Sample Time in Seconds  
X 1.0000

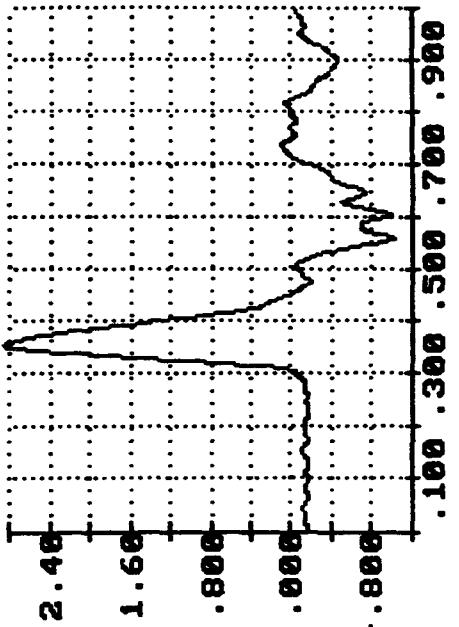
RAIL IMPACT TEST OF ATTACHS UN TOFC  
DATE: 12 JULY 1989  
SPEED: 8.23 MPH



Sample Time in Seconds  
X 1.0000



Sample Time in Seconds  
X 1.0000

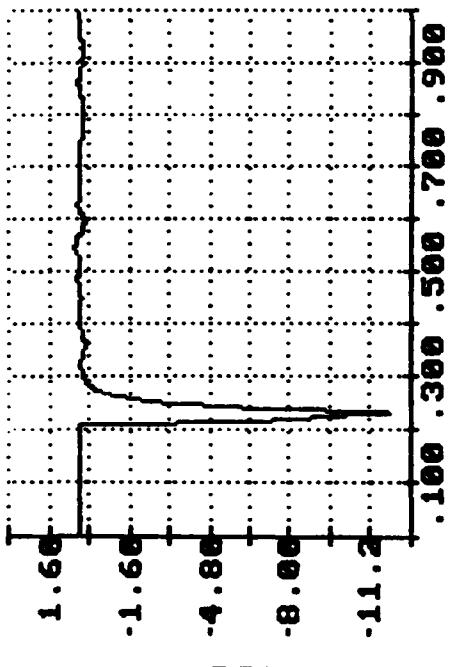


Sample Time in Seconds  
X 1.0000

Sample Time in Seconds  
X 1.0000

Sample Time in Seconds  
X 1.0000

RAIL IMPACT TEST OF ATTACHS ON TOFC  
DATE: 12 JULY 1989  
SPEED: 8.23 MPH



IN G.S. X 1.0000

LATERAL ACCELERATION -

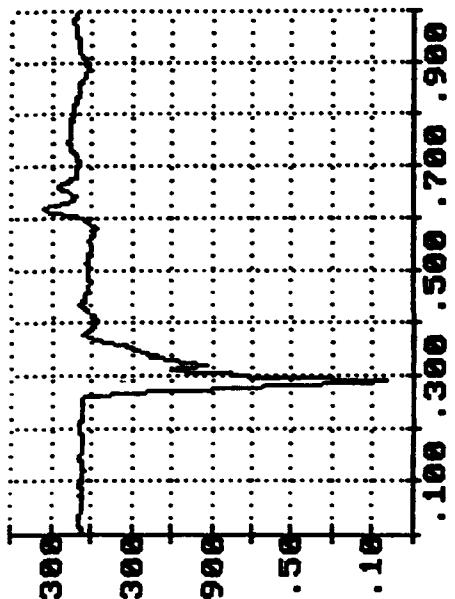
ON REAR BLOCK

IN G.S. X 1.0000

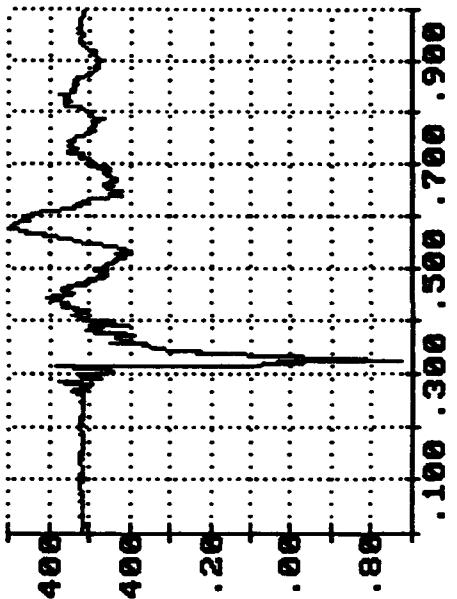
SAMPLE TIME IN SECONDS

X 1.0000

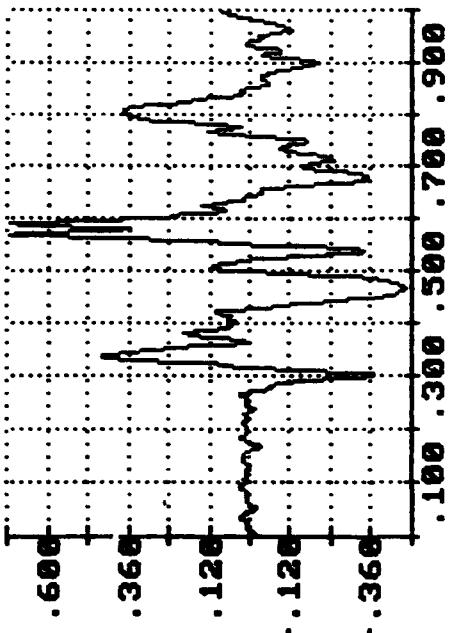
Sample Time (s)	Lateral Acceleration (g)
0.000	-0.8
0.050	-0.8
0.100	-0.8
0.150	-0.8
0.200	-0.8
0.250	1.6
0.300	1.6
0.350	1.6
0.400	1.6
0.450	1.6
0.500	-0.2
0.550	-0.2
0.600	-0.2
0.650	-0.2
0.700	-0.2
0.750	-0.2
0.800	-0.2
0.850	-0.2
0.900	-0.2
0.950	-0.2
1.000	-0.2



Sample Time in Seconds      Sample Time in Seconds  
LONG ATION      X 1.0000  
X 1.0000



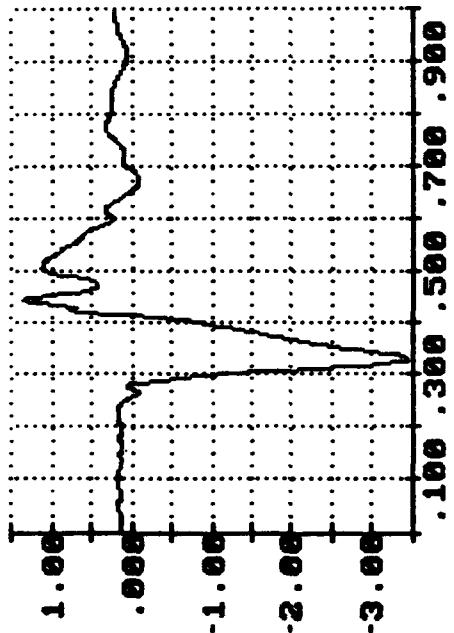
IN 5.5 X 1.0000  
N ON BOXCAR FLOOR  
VERTICAL ACCELERATION



IN G.S X 1.0000  
N ON REAR BLOCK  
VERTICAL ACCELERATION

ROLL IMPACT TEST OF ATTACHES ON TOFC

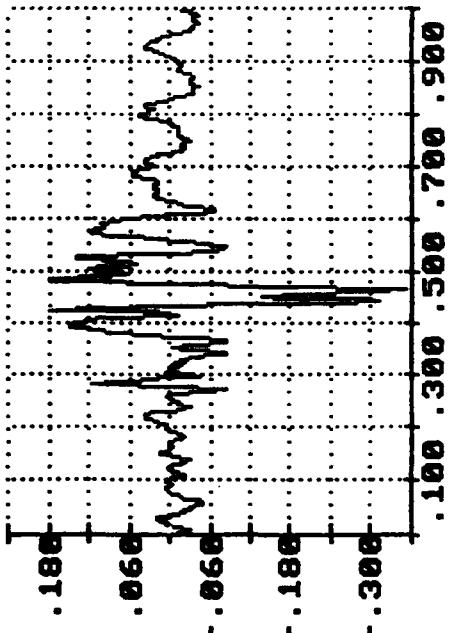
DATE: 12 JULY 1989  
SPEED: 8.54 MPH (REVERSE)



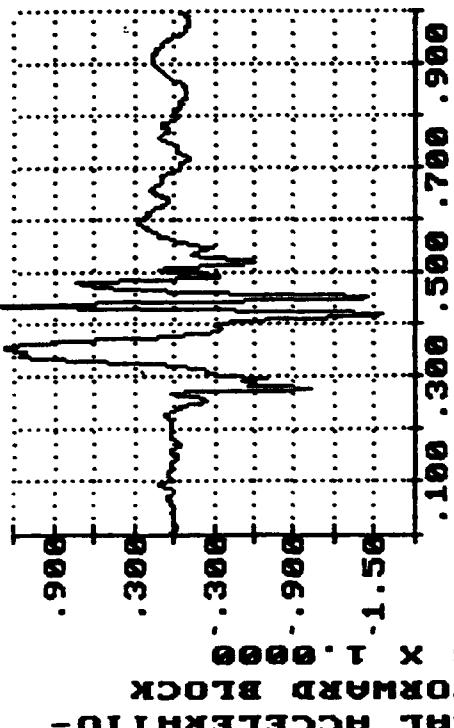
LONGITUDINAL ACCELERATION  
ATTACHMENT ON FORWARD BLOCK  
IN G'S X 1.0000



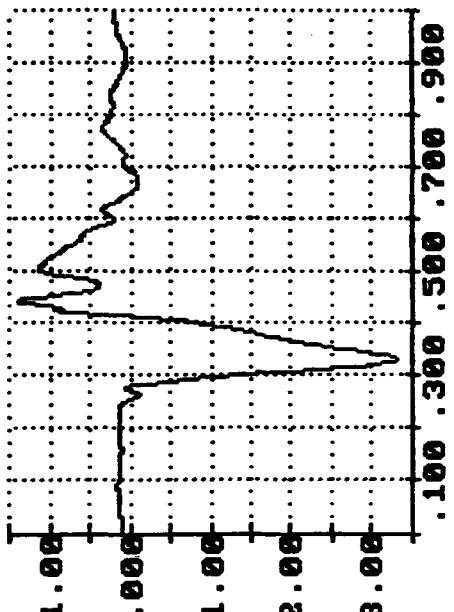
VERTICAL ACCELERATION  
ATTACHMENT ON FORWARD BLOCK  
IN G'S X 1.0000



LATERAL ACCELERATION  
ATTACHMENT ON FORWARD BLOCK  
IN G'S X 1.0000



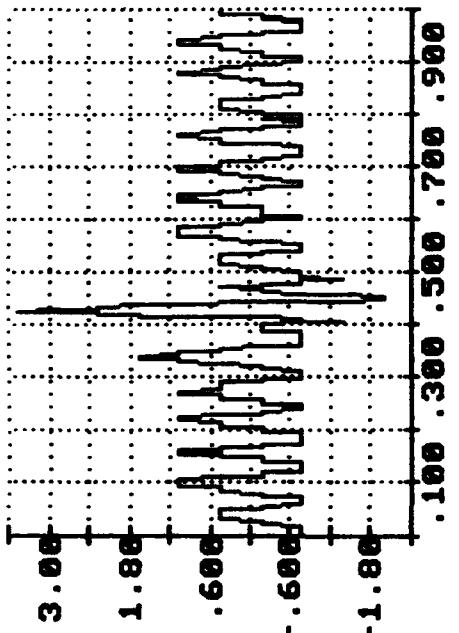
LONGITUDINAL ACCELERATION  
ATTACHMENT ON MIDDLE BLOCK  
IN G'S X 1.0000



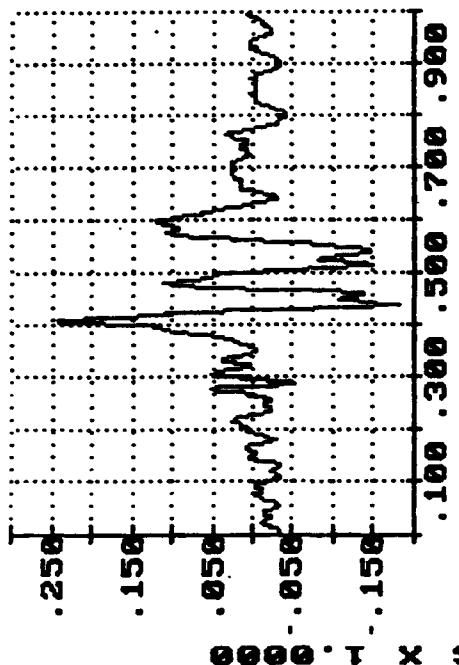
VERTICAL ACCELERATION  
ATTACHMENT ON MIDDLE BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000

RAIL IMPACT TEST OF ATTACHS ON TOFC  
DATE: 12 JULY 1989  
SPEED: 8.54 MPH (REVERSE)

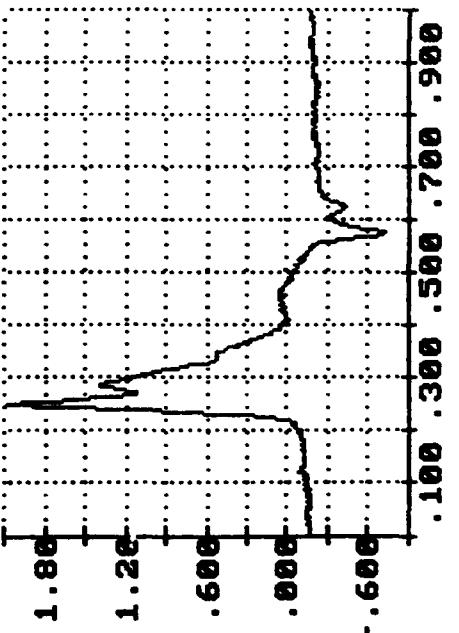


LATERAL ACCELERATION  
ON MIDDLE BLOCK  
IN POUNDS X 100000.000 IN G.S X .0100



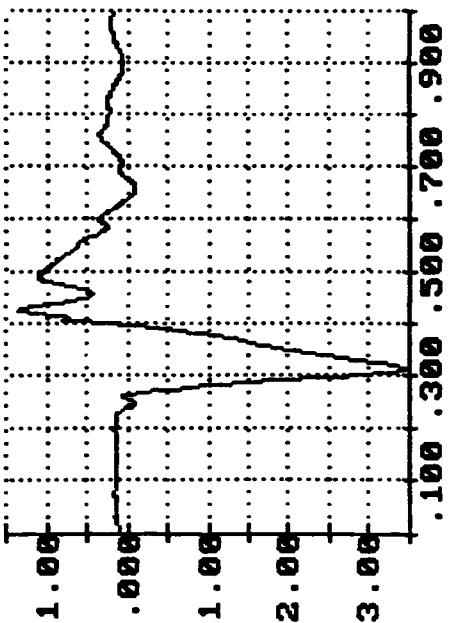
VERTICAL ACCELERATION  
ON MIDDLE BLOCK  
IN G.S X 1.0000

Sample Time in Seconds  
X 1.0000



LONGITUDINAL ACCELER-  
ATION ON MIDDLE BLOCK  
IN G.S X 1.0000

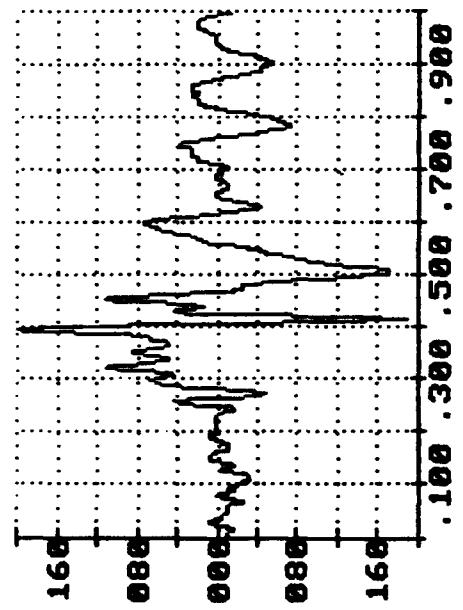
Sample Time in Seconds  
X 1.0000



Sample Time in Seconds  
X 1.0000

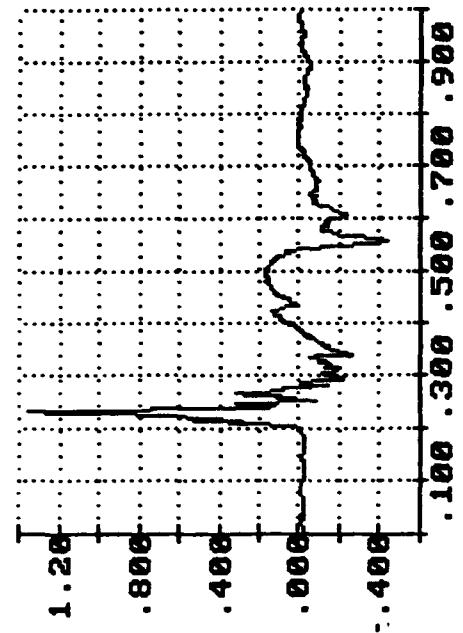
Sample Time in Seconds  
X 1.0000

RAIL IMPACT TEST OF ATTACHS ON TOFC  
DATE: 12 JULY 1989  
SPEED: 8.54 MPH (REVERSE)



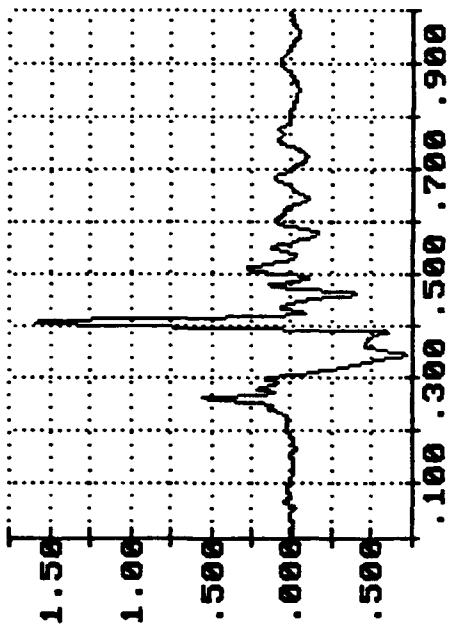
LATERAL ACCELERATION  
ON REAR BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000



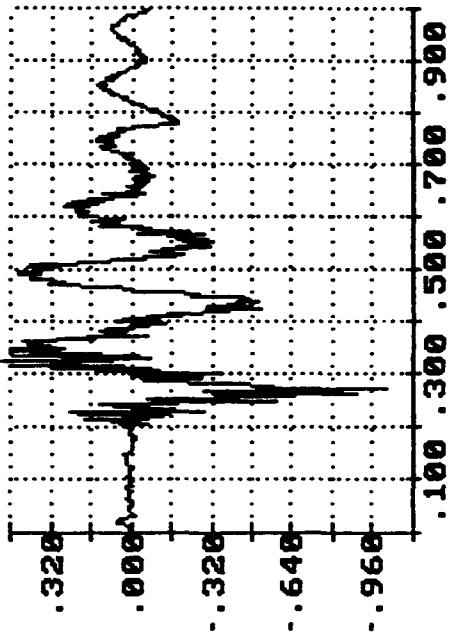
LONGITUDINAL ACCELERATION  
IN G'S X 1.0000  
ACTION ON BOXCAR FLOOR

Sample Time in Seconds  
X 1.0000



VERTICAL ACCELERATION  
IN G'S X 1.0000  
ON REAR BLOCK

Sample Time in Seconds  
X 1.0000



VERTICAL ACCELERATION  
IN G'S X 1.0000  
ON BOXCAR FLOOR

Sample Time in Seconds  
X 1.0000

ROAD TEST DATA

TEST NO: 7

DATE: 12 JULY 1989

TEST SPECIMEN: ATACMS on LRP in a MILVAN and chassis.

PASS 1-A OVER FIRST SERIES OF TIES: 0.10 MIN 5.68 MPH

PASS 1-B OVER SECOND SERIES OF TIES: 0.10 MIN 5.68 MPH

REMARKS: No visible damage to load.

PASS 2-A OVER FIRST SERIES OF TIES: 0.10 MIN 5.68 MPH

PASS 2-B OVER SECOND SERIES OF TIES: 0.10 MIN 5.58 MPH

REMARKS: Rear chock came out of position on left side. Repositioned and sent on 30 mile road trip.

30 MILE ROAD TEST: No visible damage.

PANIC STOP TEST: Not performed.

PASS 3-A OVER FIRST SERIES OF TIES: 0.10 MIN 5.68 MPH

PASS 3-B OVER SECOND SERIES OF TIES: 0.10 MIN 5.68 MPH

REMARKS: No visible damage.

PASS 4-A OVER FIRST SERIES OF TIES: 0.10 MIN 5.68 MPH

PASS 4-B OVER SECOND SERIES OF TIES: 0.10 MIN 5.68 MPH

REMARKS: No visible damage to load.

WASHBOARD COURSE: No visible damage.

RESULTS FROM ROAD HAZARD TESTING OF  
 ATACMS ON LRP  
 DATE: 12 JULY 1989

TAPE CHANNEL 1 : LONGITUDINAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	-1.22	149.77	.0506
PASS 1, COURSE B	8.00	-1.21	74.53	.0569
PASS 2, COURSE A	8.00	-1.19	135.55	.0527
PASS 2, COURSE B	8.00	-1.20	76.35	.0584
WASHBOARD COURSE	8.00	-.46	39.78	.0105

TAPE CHANNEL 2 : LATERAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	-1.18	102.44	.0814
PASS 1, COURSE B	8.00	-1.21	107.31	.0840
PASS 2, COURSE A	8.00	-1.10	98.73	.0721
PASS 2, COURSE B	8.00	-1.14	74.15	.0621
WASHBOARD COURSE	8.00	-.20	16.06	.0013

TAPE CHANNEL 3 : VERTICAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	2.93	44.56	.0927
PASS 1, COURSE B	8.00	2.93	51.83	.1077
PASS 2, COURSE A	8.00	3.00	35.69	.0800
PASS 2, COURSE B	8.00	2.90	55.30	.1198
WASHBOARD COURSE	8.00	1.16	29.76	.0199

TAPE CHANNEL 4 : LONGITUDINAL ACCELERATION ON MIDDLE BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	-1.21	121.68	.0542
PASS 1, COURSE B	8.00	-1.17	75.73	.0554
PASS 2, COURSE A	8.00	-1.16	131.58	.0515
PASS 2, COURSE B	8.00	-1.17	76.25	.0544
WASHBOARD COURSE	8.00	-.47	40.33	.0108

TAPE CHANNEL 5 : LATERAL ACCELERATION ON MIDDLE BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	1.81	78.06	.0871
PASS 1, COURSE B	8.00	1.97	70.79	.1029
PASS 2, COURSE A	8.00	1.82	215.33	.0287
PASS 2, COURSE B	8.00	1.83	150.49	.0745
WASHBOARD COURSE	8.00	.73	54.44	.0208

TAPE CHANNEL 7 : VERTICAL ACCELERATION ON MIDDLE BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	1.05	80.15	.0600
PASS 1, COURSE B	8.00	-1.29	120.02	.1048
PASS 2, COURSE A	8.00	1.07	102.32	.0718
PASS 2, COURSE B	8.00	-1.26	137.19	.1158
WASHBOARD COURSE	8.00	-.14	38.60	.0035

TAPE CHANNEL 8 : LONGITUDINAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	-1.14	139.90	.0462
PASS 1, COURSE B	8.00	-1.12	74.75	.0504
PASS 2, COURSE A	8.00	-1.10	78.26	.0556
PASS 2, COURSE B	8.00	-1.11	87.15	.0448
WASHBOARD COURSE	8.00	-.45	40.11	.0103

TAPE CHANNEL 9 : LATERAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	-.62	88.08	.0367
PASS 1, COURSE B	8.00	-.69	111.87	.0520
PASS 2, COURSE A	8.00	-.60	125.16	.0376
PASS 2, COURSE B	8.00	-.70	113.46	.0517
WASHBOARD COURSE	8.00	-.15	21.04	.0017

TAPE CHANNEL 10 : VERTICAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	.89	26.05	.0130
PASS 1, COURSE B	8.00	.93	44.08	.0313
PASS 2, COURSE A	8.00	.86	28.06	.0137
PASS 2, COURSE B	8.00	.94	67.32	.0485
WASHBOARD COURSE	8.00	-.59	*****	*****

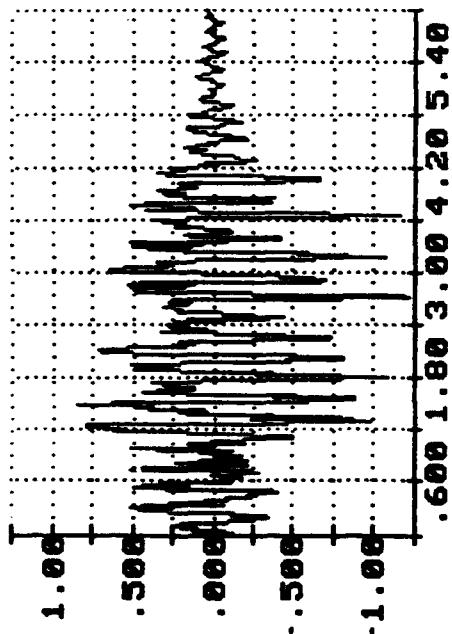
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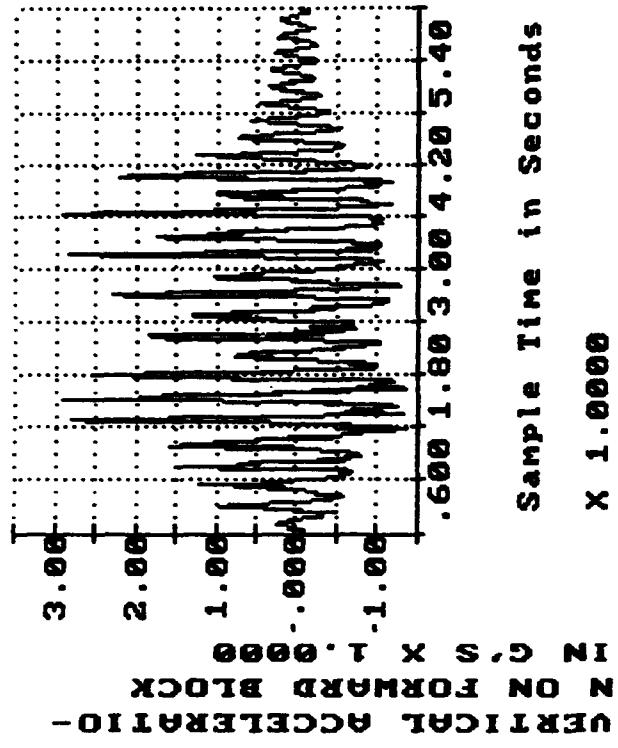
ROAD HAZARD TEST OF ATACMS ON LWP

DATE: 12 JULY 1989

PASS 1, COURSE A

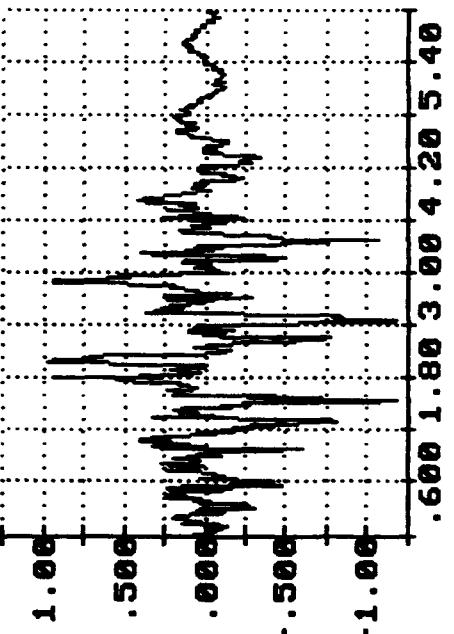


LONGITUDINAL ACCELERATION  
ON FORWARD BLOCK  
IN G'S X 1.0000

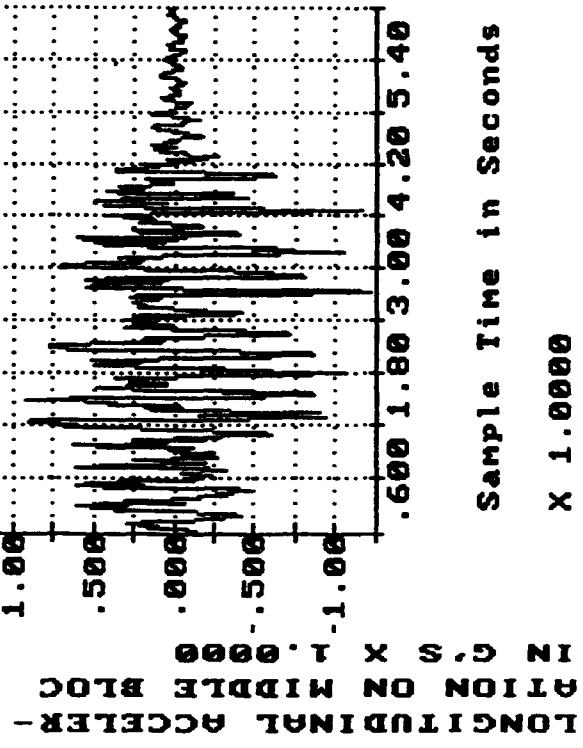


VERTICAL ACCELERATION  
ON FORWARD BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000

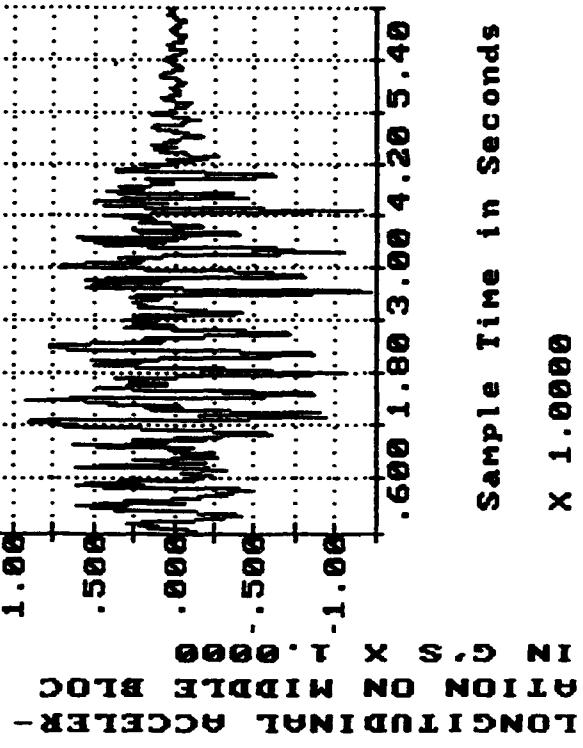


LATERAL ACCELERATION  
ON FORWARD BLOCK  
IN G'S X 1.0000



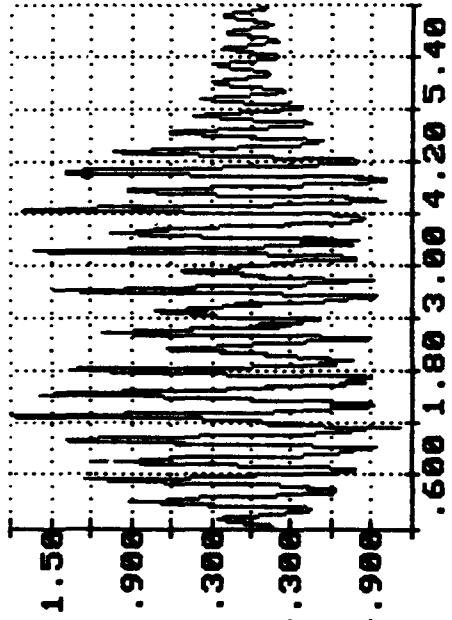
LONGITUDINAL ACCELERATION  
ON MIDDLE BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000



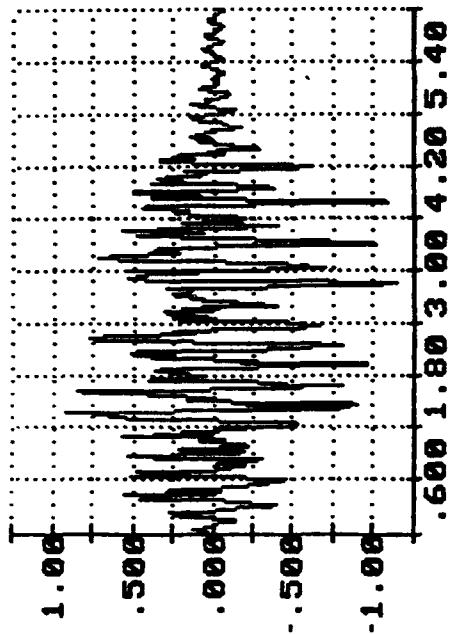
VERTICAL ACCELERATION  
ON MIDDLE BLOCK  
IN G'S X 1.0000

ROAD HAZARD TEST OF ATTACHS ON LRP  
DATE: 12 JULY 1989  
PASS 1, COURSE A



LATERAL ACCELERATION -  
ON MIDDLE BLOCK  
ACTION ON MIDDLE BLOCK

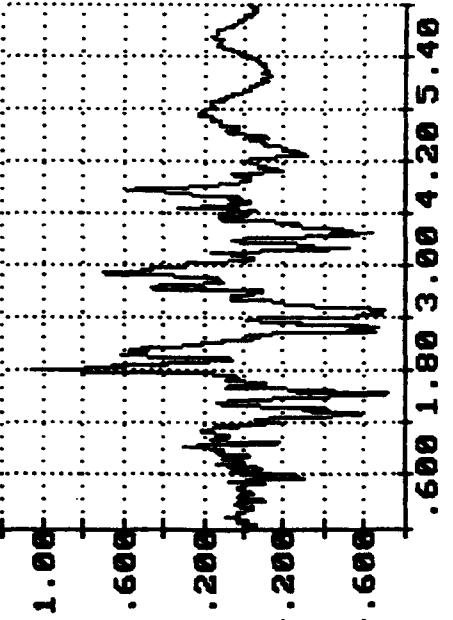
IN G'S X 1.0000



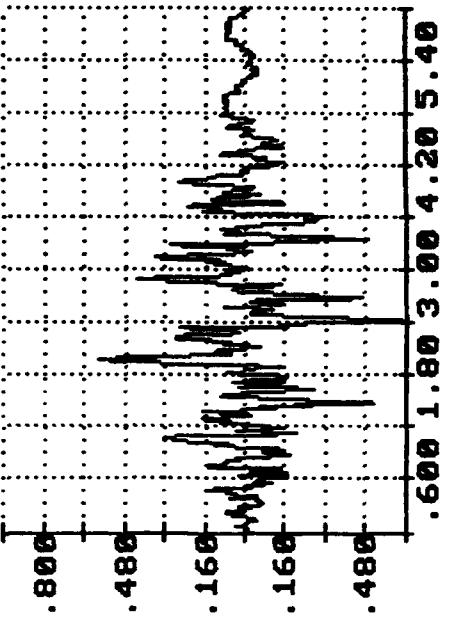
LONGITUDINAL ACCELERATION -  
ON REAR BLOCK  
ACTION ON MIDDLE BLOCK

IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000



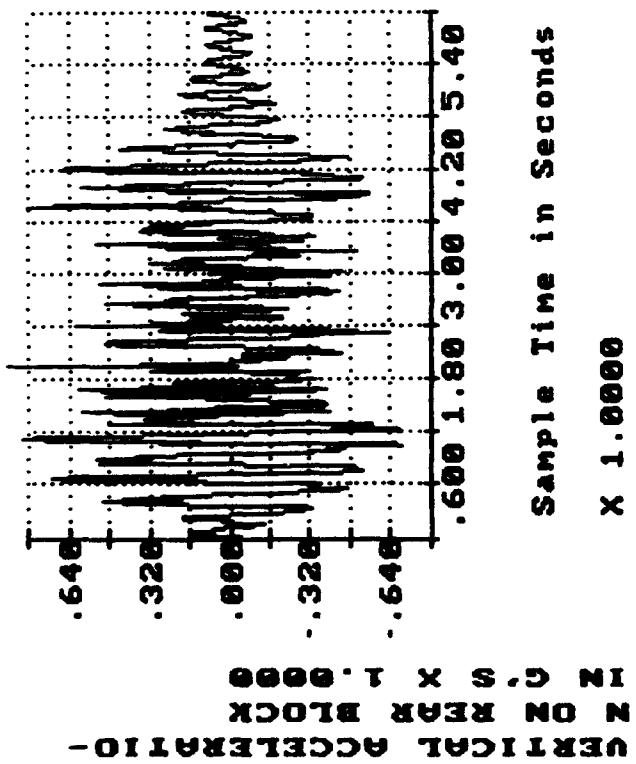
VERTICAL ACCELERATION -  
ON MIDDLE BLOCK  
IN G'S X 1.0000



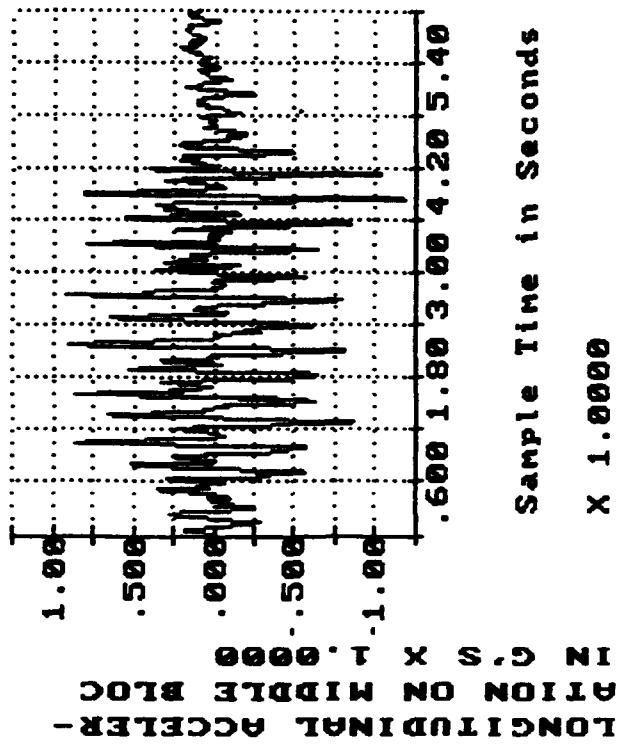
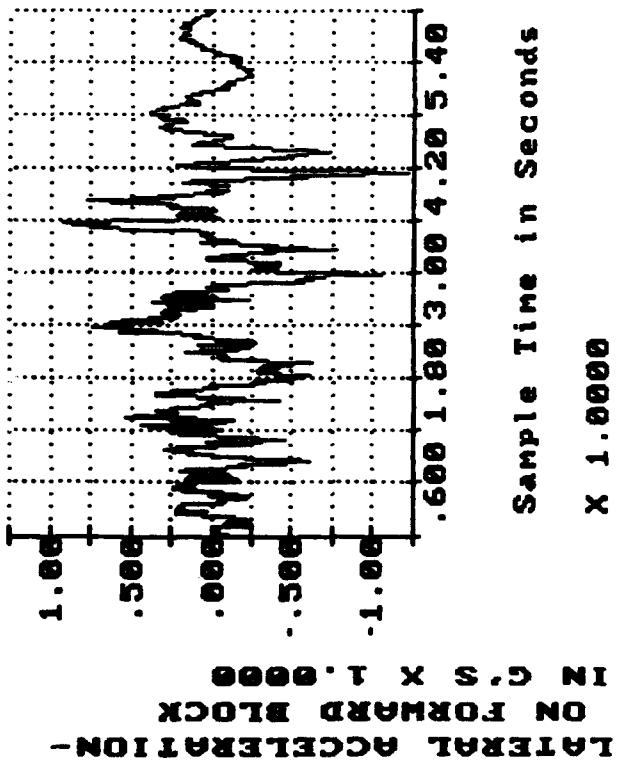
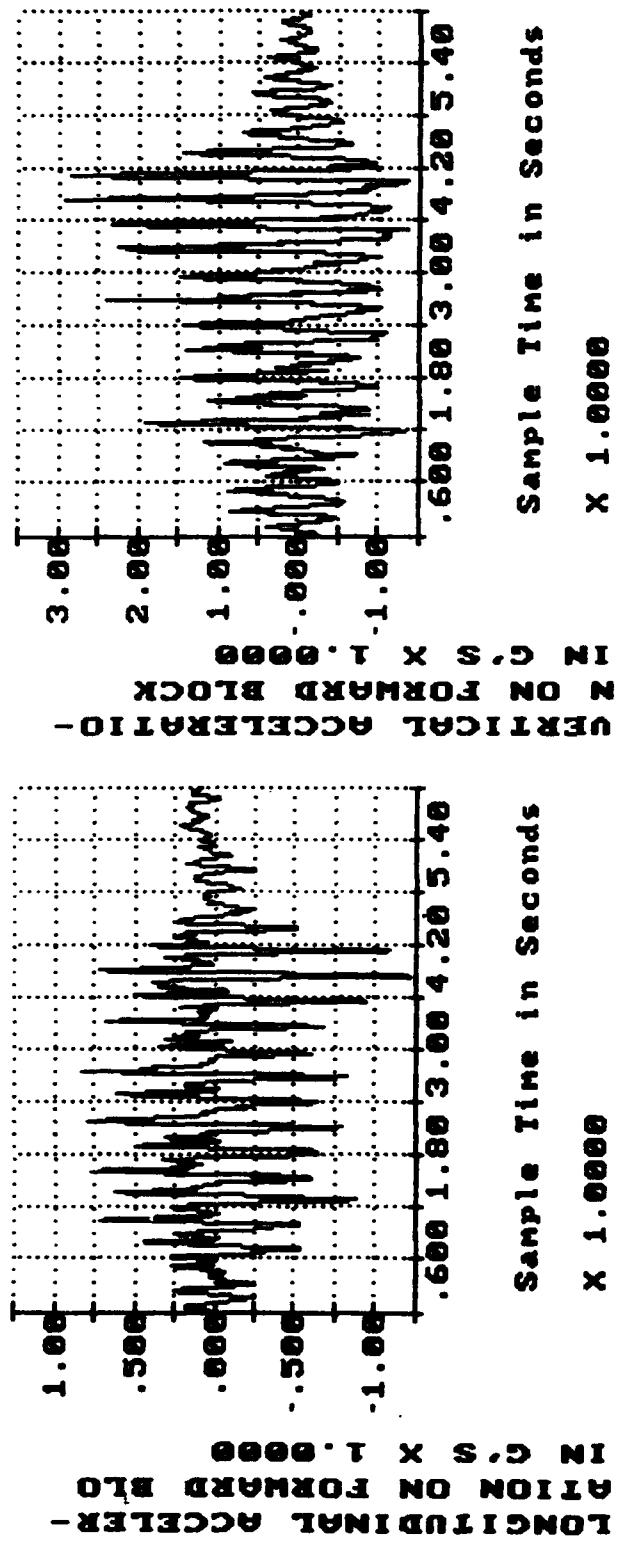
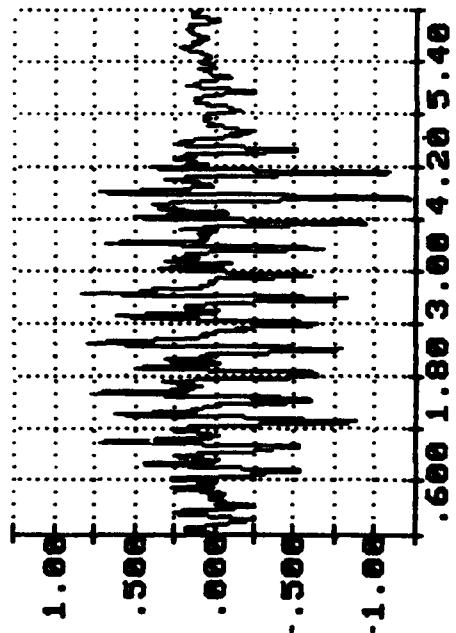
LATERAL ACCELERATION -  
ON REAR BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000

ROAD HAZARD TEST OF ATACMS ON LRP  
DATE: 12 JULY 1989  
PASS 1, COURSE A



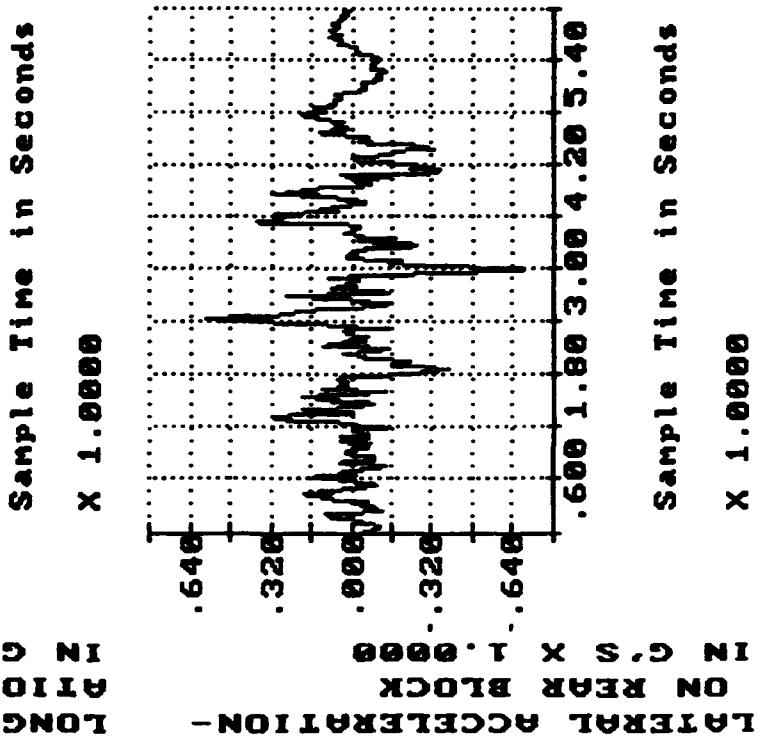
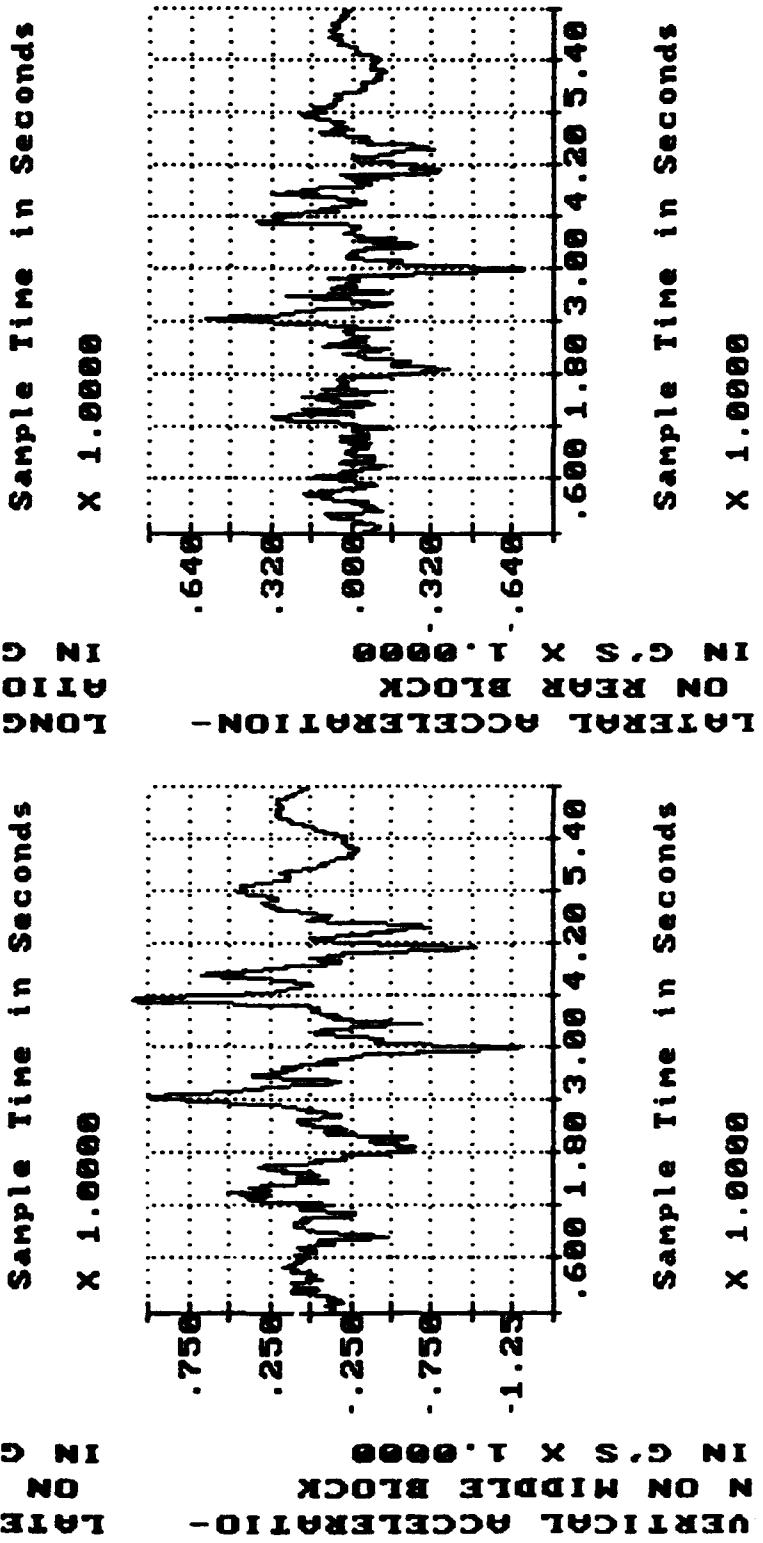
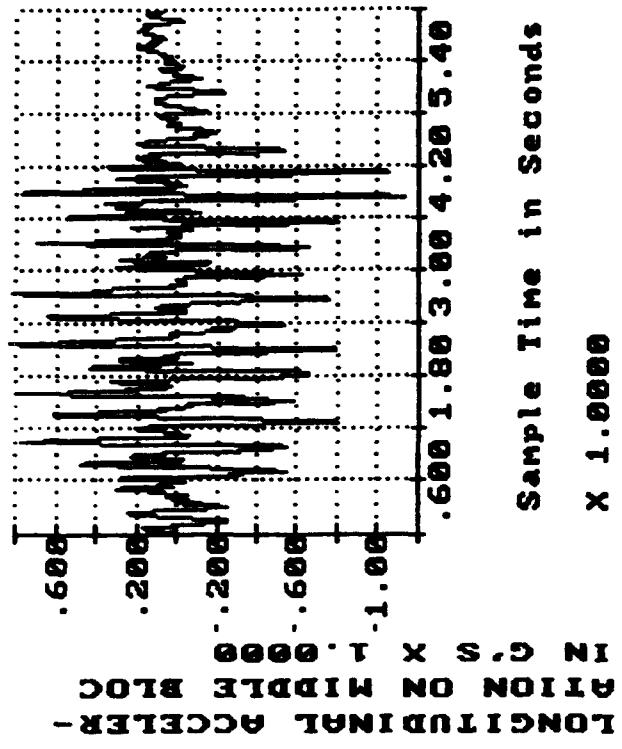
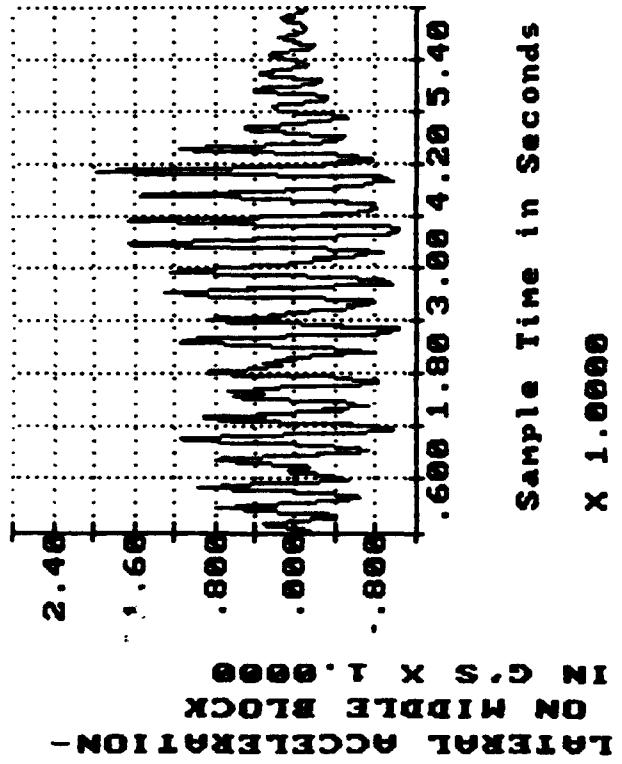
ROAD HAZARD TEST OF ATTACHS ON LRP  
DATE: 12 JULY 1989  
PASS 1, COURSE B



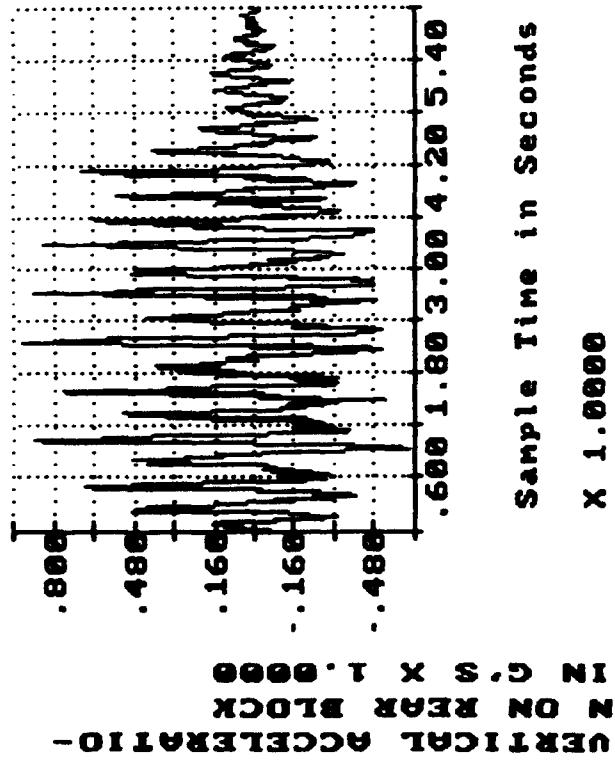
Sample Time in Seconds  
X 1.0000

Sample Time in Seconds  
X 1.0000

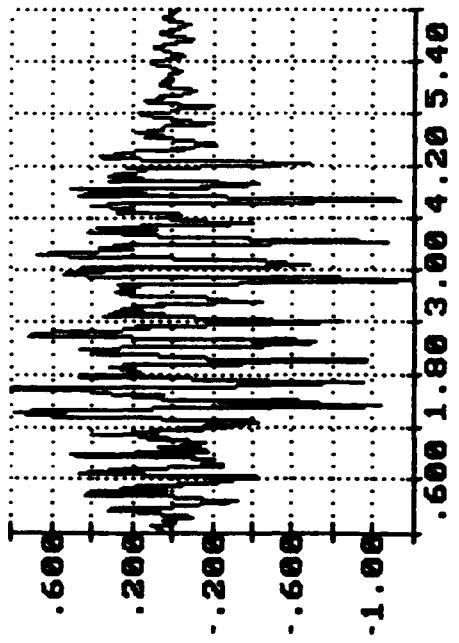
ROAD HAZARD TEST OF AIRCRAFT ON LRP  
DATE: 12 JULY 1989  
PASS 1, COURSE B



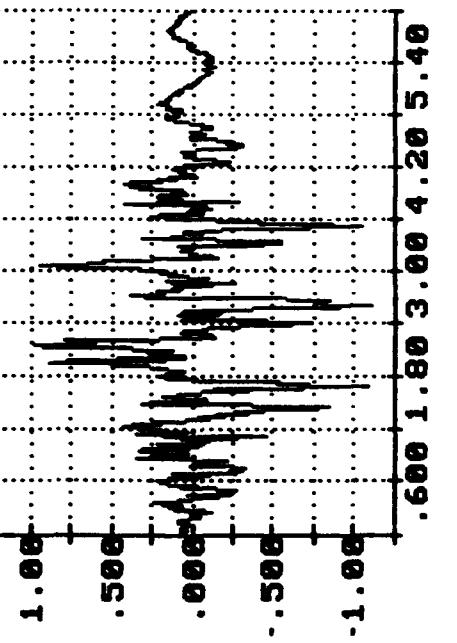
ROAD HAZARD TEST OF ATACHS ON LRP  
DATE: 12 JULY 1989  
PASS 1, COURSE B



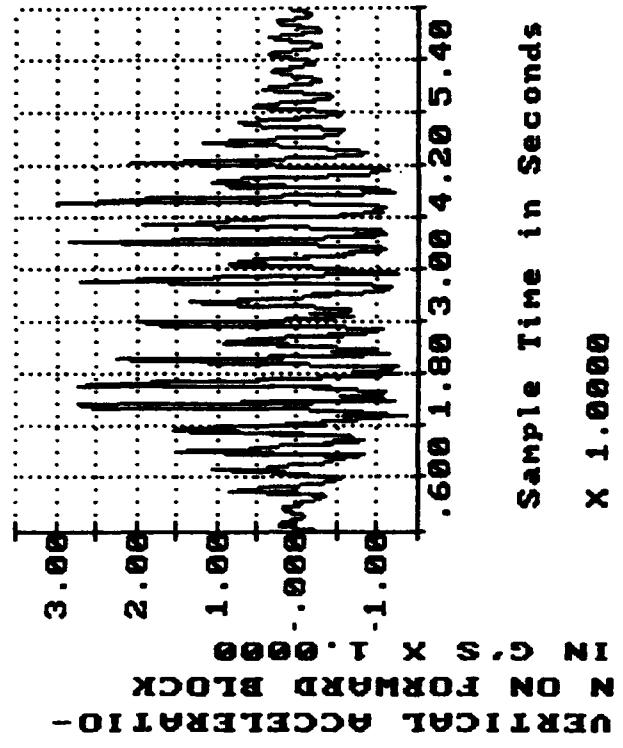
ROAD HAZARD TEST OF ATACMS ON LRP  
DATE: 12 JULY 1989  
PASS 2, COURSE A



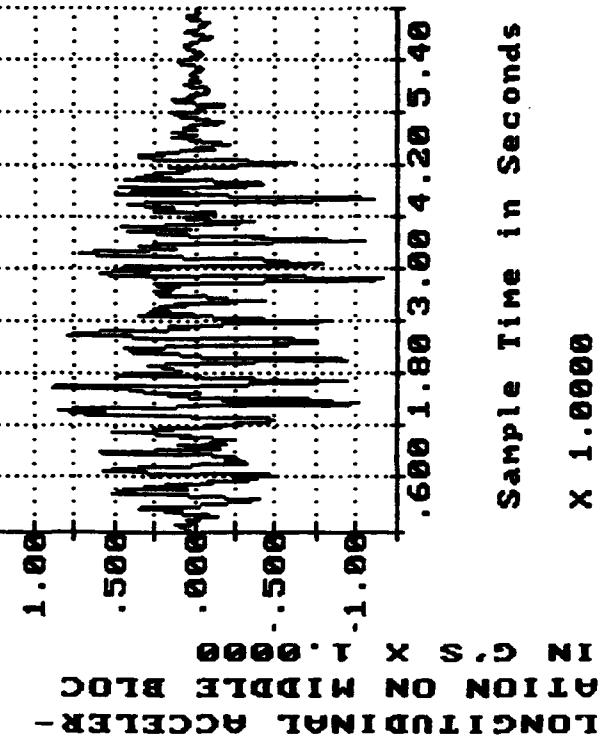
Sample Time in Seconds  
X 1.0000



Sample Time in Seconds  
X 1.0000

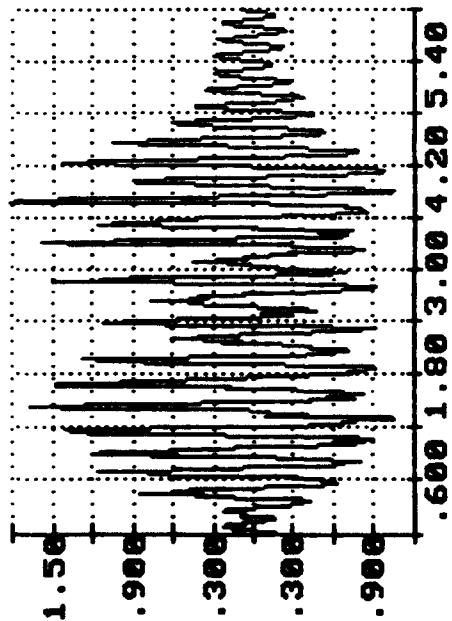


Sample Time in Seconds  
X 1.0000

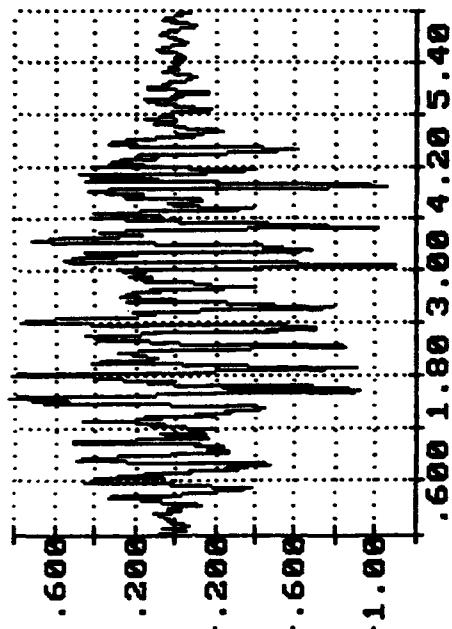


Sample Time in Seconds  
X 1.0000

ROAD HAZARD TEST ON HIACHS UN LRP  
DATE: 12 JULY 1989  
PASS 2, COURSE A



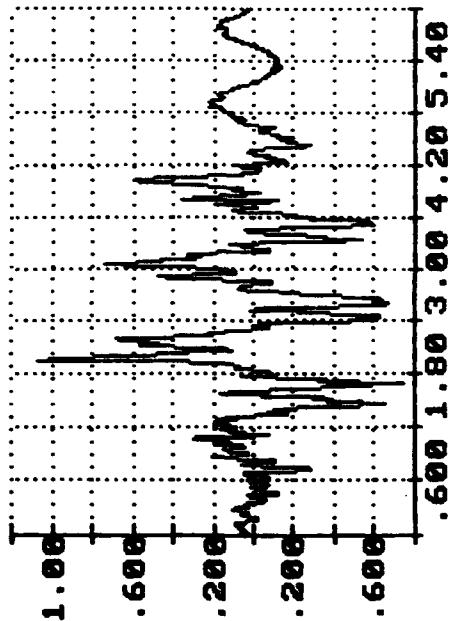
LATERAL ACCELERATION -  
ON MIDDLE BLOCK  
IN G.S X 1.0000



LONGITUDINAL ACCELERATION -  
ATITION ON MIDDLE BLOCK  
IN G.S X 1.0000

Sample Time in Seconds  
X 1.0000

Sample Time in Seconds  
X 1.0000



VERTICAL ACCELERATION -  
ON MIDDLE BLOCK  
IN G.S X 1.0000

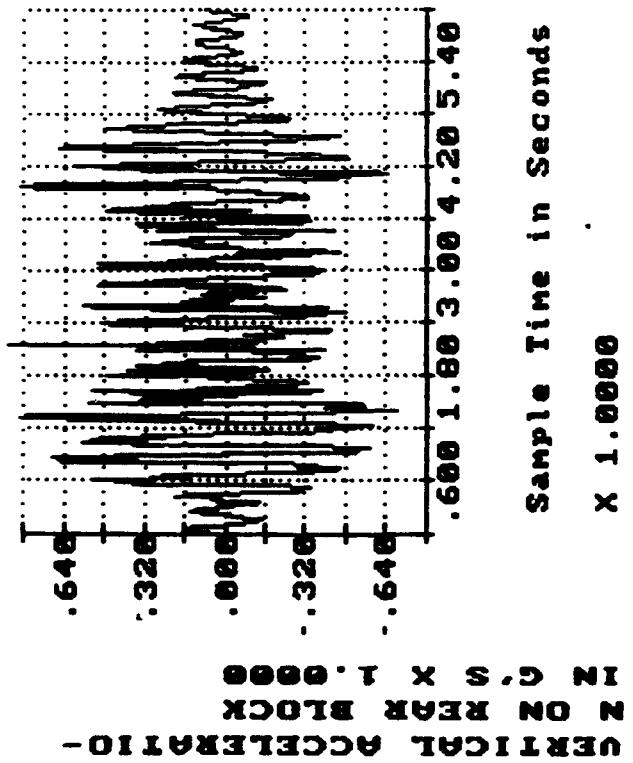
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LATERAL ACCELERATION -  
ON REAR BLOCK  
IN G.S X 1.0000

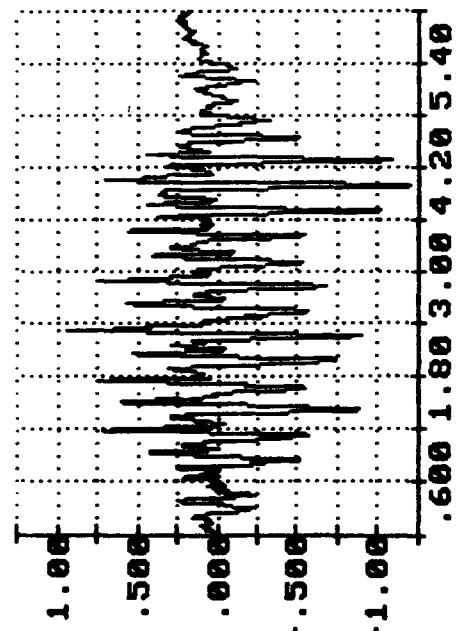
Sample Time in Seconds  
X 1.0000

Sample Time in Seconds  
X 1.0000

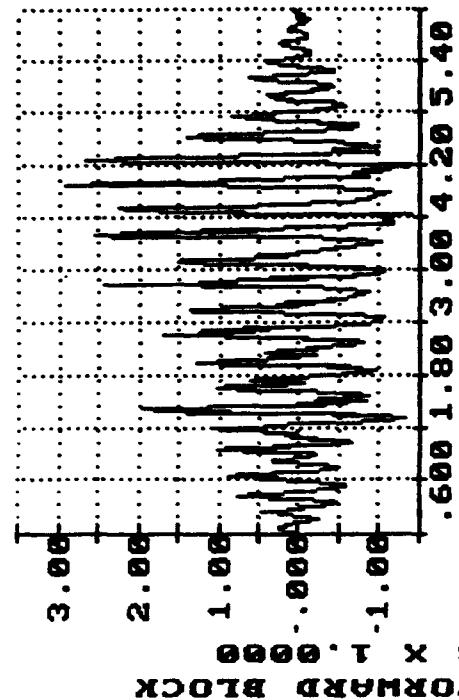
ROAD HAZARD TEST OF ATACMS ON LRP  
DATE: 12 JULY 1989  
PASS 2, COURSE A



ROAD HAZARD TEST OF ATACMS ON LKP  
DATE: 12 JULY 1989  
PASS 2, COURSE B

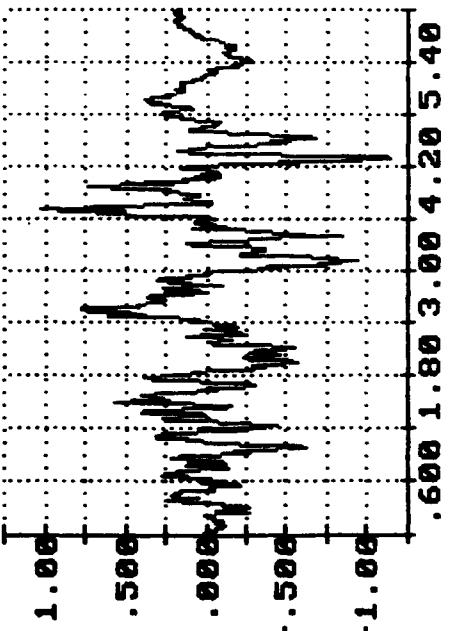


LONGITUDINAL ACCELERATION  
ON FORWARD BLOCK  
IN G'S X 1.0000



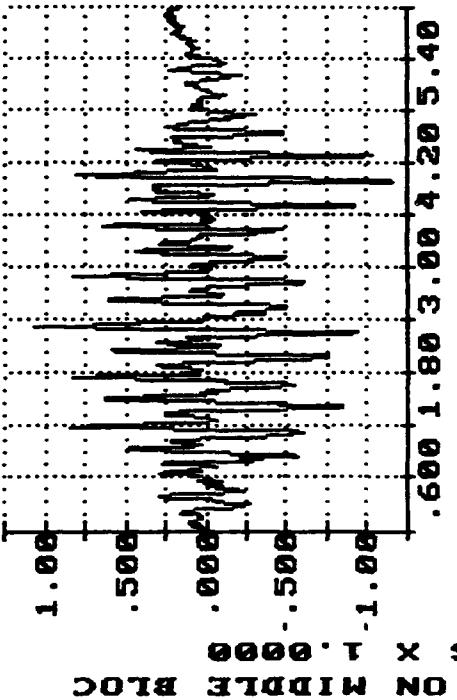
VERTICAL ACCELERATION  
IN ON FORWARD BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
x 1.0000



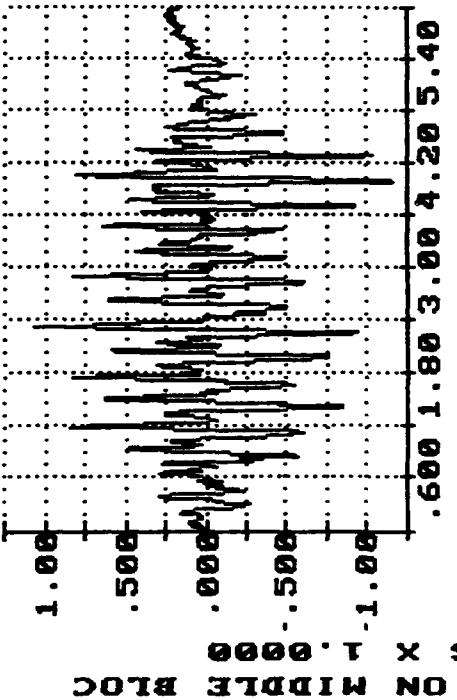
LATERAL ACCELERATION  
ON FORWARD BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
x 1.0000



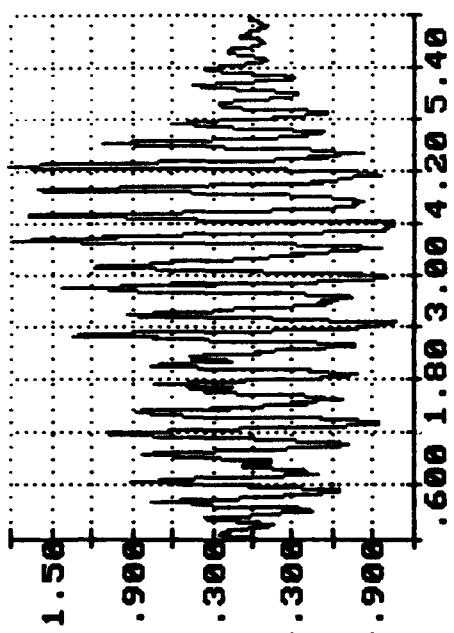
LONGITUDINAL ACCELERATION  
ON MIDDLE BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
x 1.0000

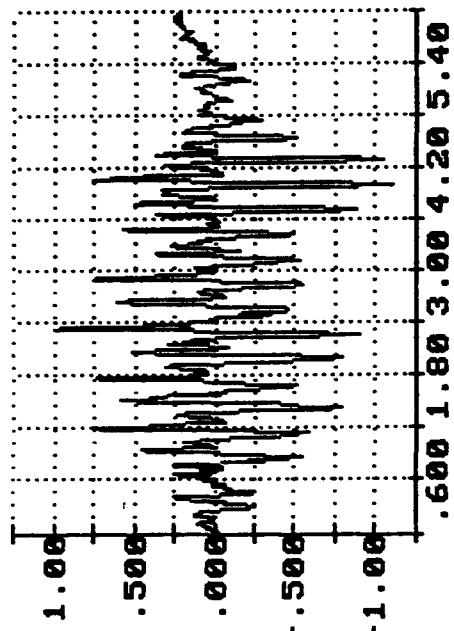


VERTICAL ACCELERATION  
IN ON MIDDLE BLOCK  
IN G'S X 1.0000

ROAD HAZARD TEST ON ATTACH UN LRP  
DATE: 12 JULY 1989  
PASS 2, COURSE B

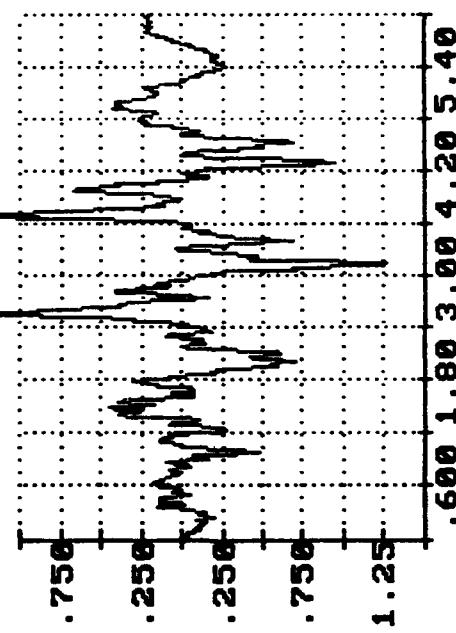


LATERAL ACCELERATION-  
ON MIDDLE BLOCK  
IN G.S X 1.0000

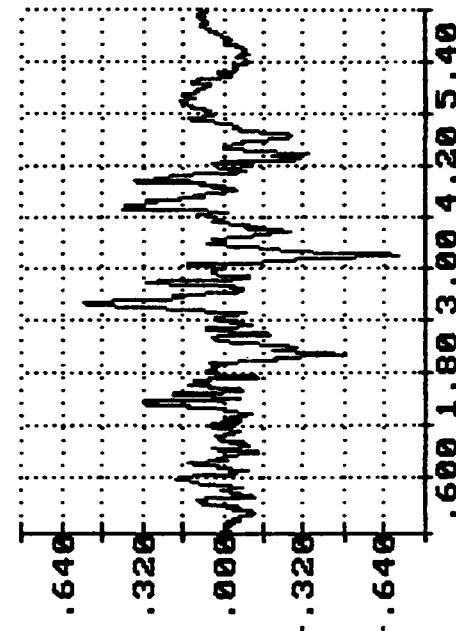


LONGITUDINAL ACCELERATION-  
IN G.S X 1.0000

Sample Time in Seconds  
X 1.0000



VERTICAL ACCELERATION-  
ON MIDDLE BLOCK  
IN G.S X 1.0000

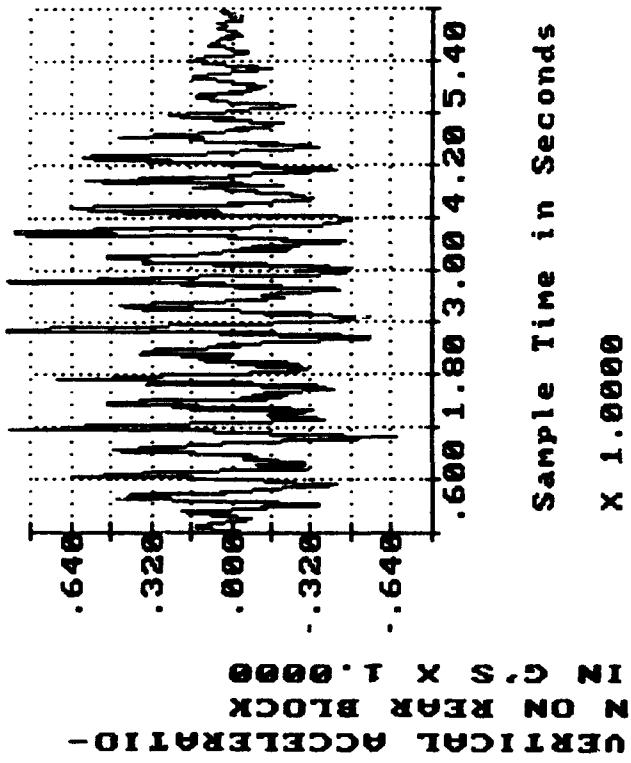


LATERAL ACCELERATION-  
ON REAR BLOCK  
IN G.S X 1.0000

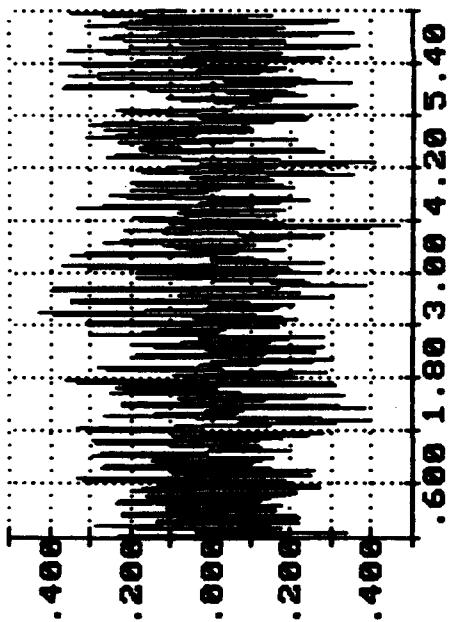
Sample Time in Seconds  
X 1.0000

Sample Time in Seconds  
X 1.0000

ROAD HAZARD TEST OF ANACMS ON LRP  
DATE: 12 JULY 1989  
PASS 2, COURSE B



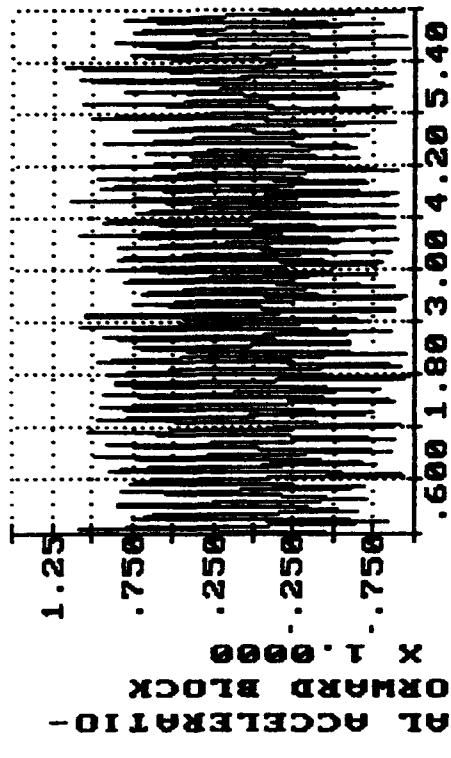
ROAD HAZARD TEST OF ATTACHS ON LRP  
DATE: 12 JULY 1989  
WASHBOARD COURSE



Sample Time in Seconds

$\times 1.0000$

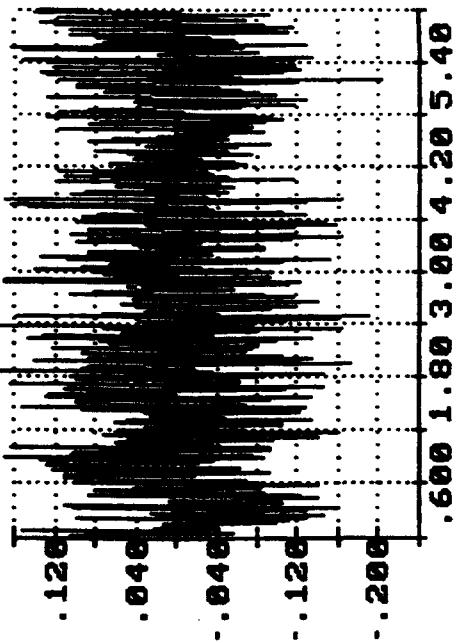
LATERAL ACCELERATION  
ON FORWARD BLOCK  
ATTACHMENT ON FORWARD BLOCK  
IN G'S X 1.0000



Sample Time in Seconds

$\times 1.0000$

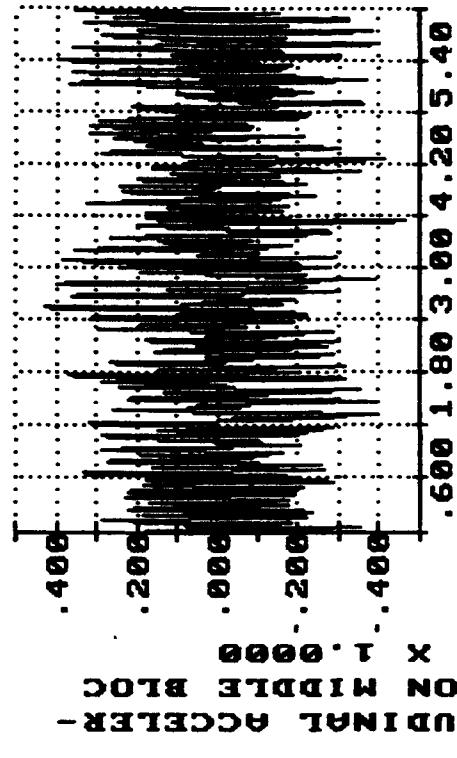
VERTICAL ACCELERATION  
IN FORWARD BLOCK  
ATTACHMENT ON FORWARD BLOCK  
IN G'S X 1.0000



Sample Time in Seconds

$\times 1.0000$

LATERAL ACCELERATION  
ON FORWARD BLOCK  
ATTACHMENT ON FORWARD BLOCK  
IN G'S X 1.0000



Sample Time in Seconds

$\times 1.0000$

LONGITUDINAL ACCELERATION  
ATTACHMENT ON MIDDLE BLOCK  
ATTACHMENT ON MIDDLE BLOCK  
IN G'S X 1.0000

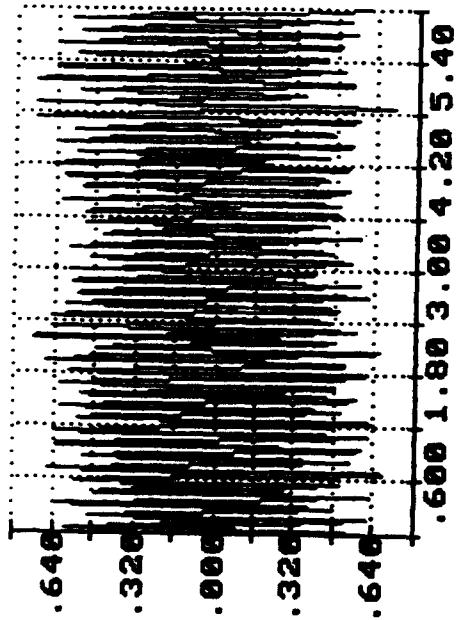
Sample Time in Seconds

$\times 1.0000$

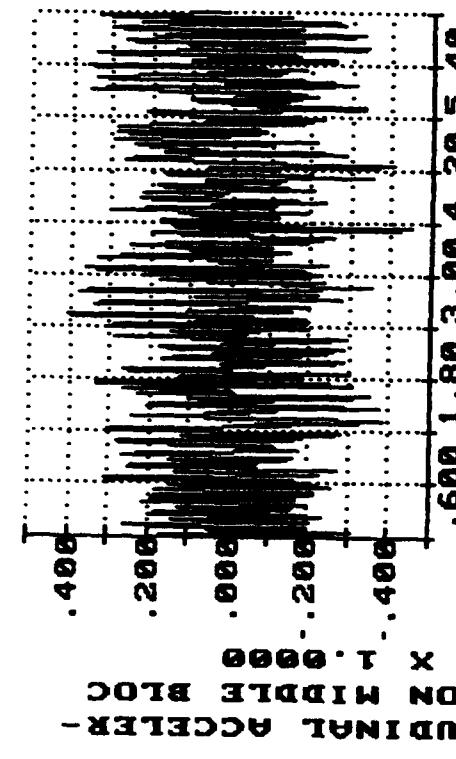
Sample Time in Seconds

$\times 1.0000$

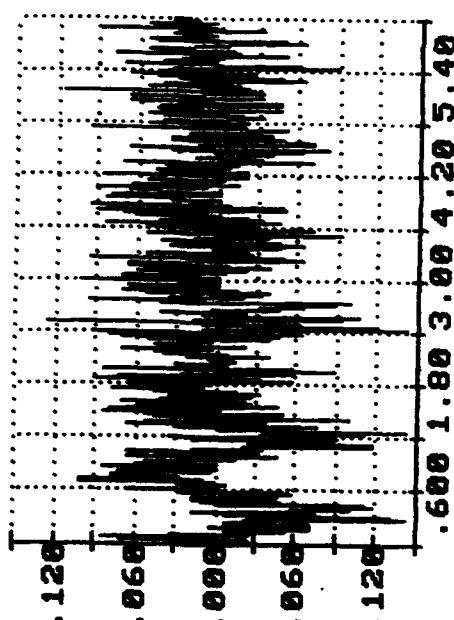
ROAD HAZARD TEST OF ATTACHS ON LKP  
DATE: 12 JULY 1989  
WASHBOARD COURSE



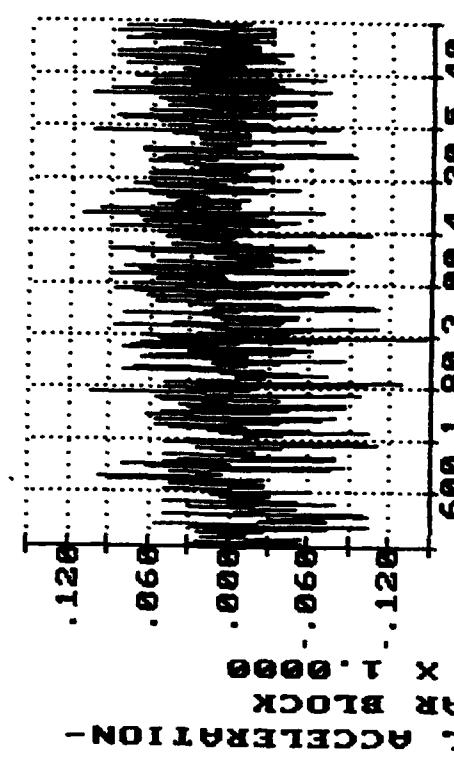
Sample Time in Seconds  
X 1.0000



Sample Time in Seconds  
X 1.0000

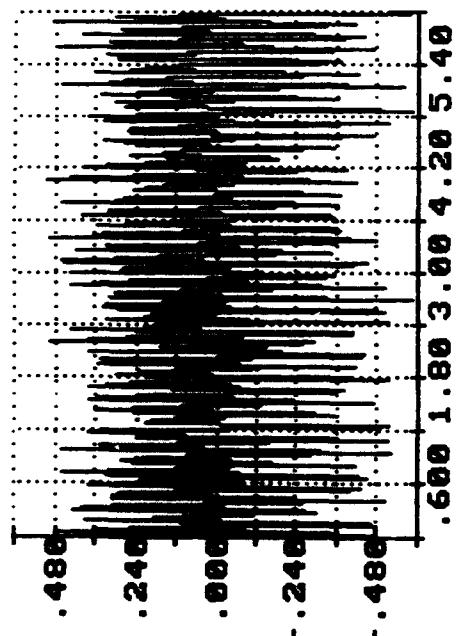


Sample Time in Seconds  
X 1.0000



Sample Time in Seconds  
X 1.0000

ROAD HAZARD TEST OF ATACMS ON LRP  
DATE: 12 JULY 1989  
WASHBOARD COURSE



VERTICAL ACCELERATION  
IN G'S X 1.0000  
ON REAR BLOCK

-

RAIL IMPACT TEST

TEST NO: 8

DATE: 13 JULY 1989

TEST SPECIMEN: ATACMS (four pods) on a flatrack.

TEST CAR NO: TTX 252005

LT. WT. 74,900 POUNDS

CHASSIS NO: 5394

LT. WT. 6,040 POUNDS

FLAT RACK NO:

LT. WT. 5,000 POUNDS

LADING AND DUNNAGE

WT. 21,000 POUNDS

TOTAL SPECIMEN WT. 106,940 POUNDS

BUFFER CAR (5 CARS) WT. 250,000 POUNDS

IMPACT NO.	END STRUCK	VELOCITY (MPH)	REMARKS
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1	Forward	4.29	No shifting or damage.
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2	Forward	6.38	No shifting or damage.
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3	Forward	8.43	No shifting or damage.
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4	Reverse	8.19	No shifting or damage.
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RESULTS FROM RAIL IMPACT TESTING OF  
ATACMS ON FLATRACK  
DATE: 13 JULY 1989

TAPE CHANNEL 1 : LONGITUDINAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.29	-1.57	126.32	.1099
IMPACT 2	6.38	-1.95	125.89	.1416
IMPACT 3	8.43	-3.15	187.83	.2058
IMPACT 4 (REVERSE)	8.19	3.46	87.05	.1815

TAPE CHANNEL 2 : LATERAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.29	.20	13.83	.0015
IMPACT 2	6.38	.18	14.58	.0013
IMPACT 3	8.43	-.19	13.46	.0016
IMPACT 4 (REVERSE)	8.19	.23	20.84	.0028

TAPE CHANNEL 3 : VERTICAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.29	-.66	23.56	.0089
IMPACT 2	6.38	.73	48.33	.0180
IMPACT 3	8.43	1.28	37.96	.0314
IMPACT 4 (REVERSE)	8.19	1.88	42.35	.0466

TAPE CHANNEL 4 : LONGITUDINAL ACCELERATION ON MIDDLE BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.29	-1.64	125.79	.1133
IMPACT 2	6.38	-2.03	115.82	.1444
IMPACT 3	8.43	-3.29	173.40	.2129
IMPACT 4 (REVERSE)	8.19	3.66	84.28	.1838

TAPE CHANNEL 5 : LATERAL ACCELERATION ON MIDDLE BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.29	.08	10.52	.0005
IMPACT 2	6.38	-.07	46.92	.0024
IMPACT 3	8.43	-.09	37.18	.0020
IMPACT 4 (REVERSE)	8.19	.75	40.43	.0201

TAPE CHANNEL 6 : RAIL COUPLER FORCE

TEST	SPEED MPH	PEAK VALUE POUNDS	DURATION MILLISECONDS	AREA POUNDS-SECONDS
IMPACT 1	4.29	129536.39	80.62	5895.41
IMPACT 2	6.38	178244.11	76.46	6461.98
IMPACT 3	8.43	220524.08	46.62	6709.13
IMPACT 4 (REVERSE)	8.19	229603.06	44.76	6902.23

TAPE CHANNEL 7 : VERTICAL ACCELERATION ON MIDDLE BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.29	-.15	34.03	.0026
IMPACT 2	6.38	.11	18.19	.0006
IMPACT 3	8.43	-.20	21.53	.0026
IMPACT 4 (REVERSE)	8.19	.34	35.52	.0079

TAPE CHANNEL 8 : LONGITUDINAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.29	-1.59	136.09	.1124
IMPACT 2	6.38	-1.94	276.52	.1280
IMPACT 3	8.43	-3.16	170.00	.2091
IMPACT 4 (REVERSE)	8.19	3.54	86.08	.1841

TAPE CHANNEL 9 : LATERAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.29	.13	19.83	.0016
IMPACT 2	6.38	.13	30.27	.0021
IMPACT 3	8.43	.21	27.19	.0038
IMPACT 4 (REVERSE)	8.19	-.28	34.49	.0062

TAPE CHANNEL 10 : VERTICAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.29	-.42	31.19	.0086
IMPACT 2	6.38	-.66	63.25	.0207
IMPACT 3	8.43	-1.20	48.54	.0370
IMPACT 4 (REVERSE)	8.19	.61	56.24	.0213

TAPE CHANNEL 12 : LONGITUDINAL ACCELERATION ON RAILCAR FLOOR

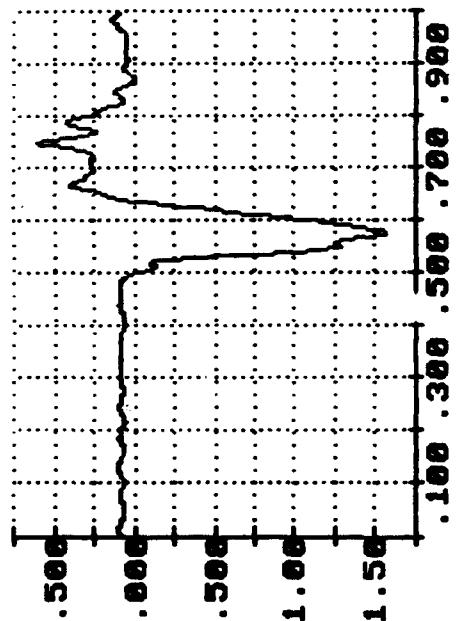
TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.29	-11.17	53.95	.4308
IMPACT 2	6.38	-4.25	21.23	.0555
IMPACT 3	8.43	.93	33.13	.0148
IMPACT 4 (REVERSE)	8.19	-2.64	38.87	.0668

TAPE CHANNEL 14 : VERTICAL ACCELERATION ON RAILCAR FLOOR

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.29	.57	8.84	.0038
IMPACT 2	6.38	-1.74	8.43	.0096
IMPACT 3	8.43	-4.03	17.11	.0519
IMPACT 4 (REVERSE)	8.19	-3.00	16.48	.0351

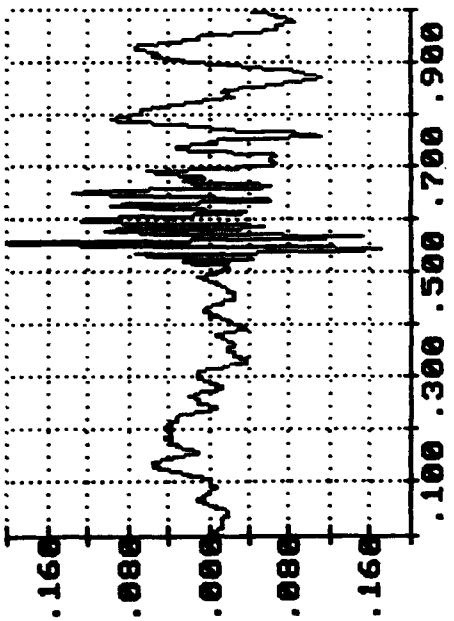
RAIL IMPACT TEST OF ATTACHS ON FLATRACK

DATE: 13 JULY 1989  
SPEED: 4.29 MPH



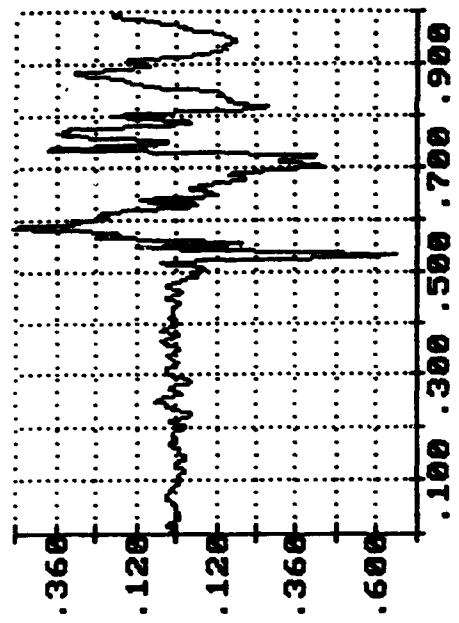
LATERAL ACCELERATION  
ATTACHMENT ON FORWARD BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000



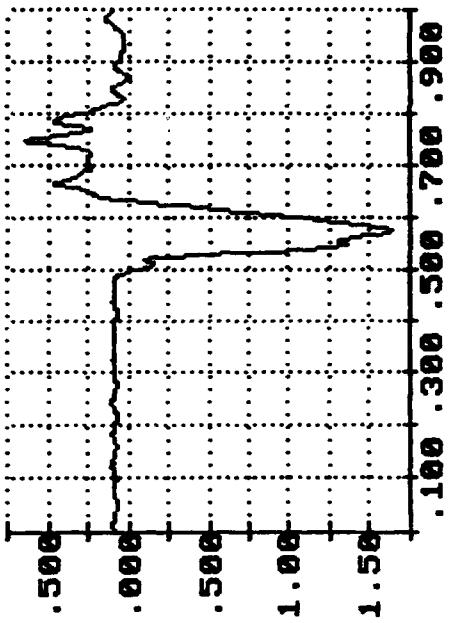
LATERAL ACCELERATION  
ATTACHMENT ON FORWARD BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000



LATERAL ACCELERATION  
ATTACHMENT IN MIDDLE BLOCK  
IN G'S X 1.0000

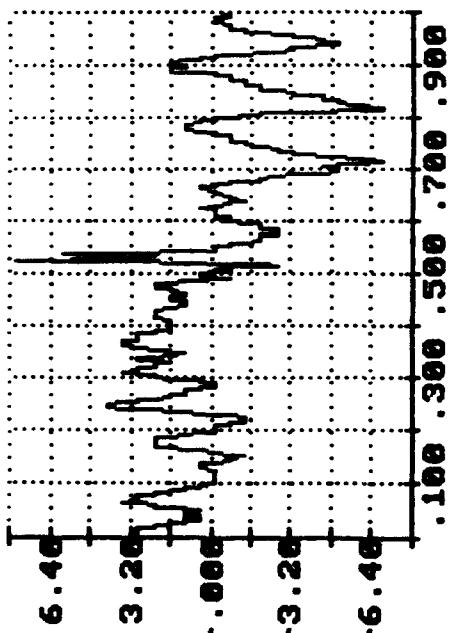
Sample Time in Seconds  
X 1.0000



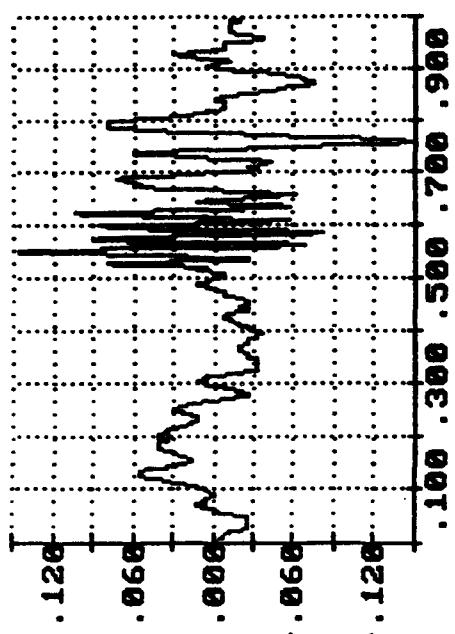
LATERAL ACCELERATION  
ATTACHMENT IN MIDDLE BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000

RAIL IMPACT TEST 1 OF ATTACHS ON FLATTRACK  
DATE: 13 July 1989 SPEED: 4.29 MPH

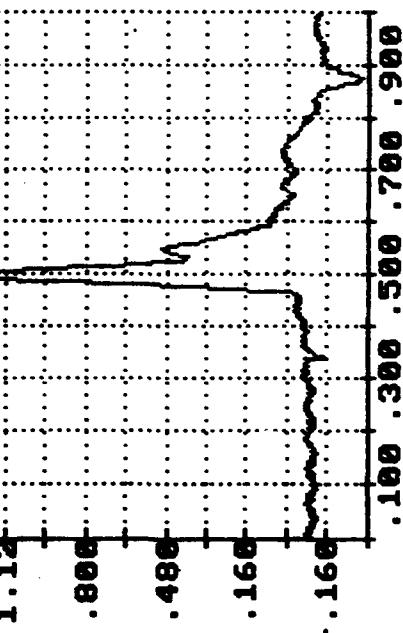


LATERAL ACCELERATION  
ON MIDDLE BLOCK  
DETERMINED IN G'S X .0100

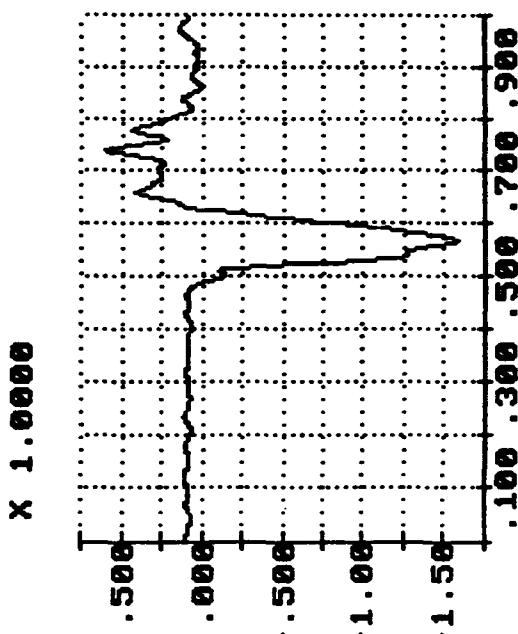


VERTICAL ACCELERATION  
ON MIDDLE BLOCK  
DETERMINED IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000



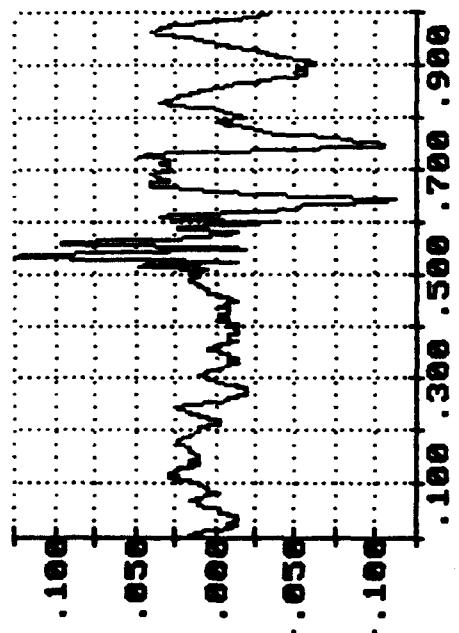
LONGITUDINAL ACCELERATION  
ON MIDDLE BLOCK  
DETERMINED IN G'S X 1.0000



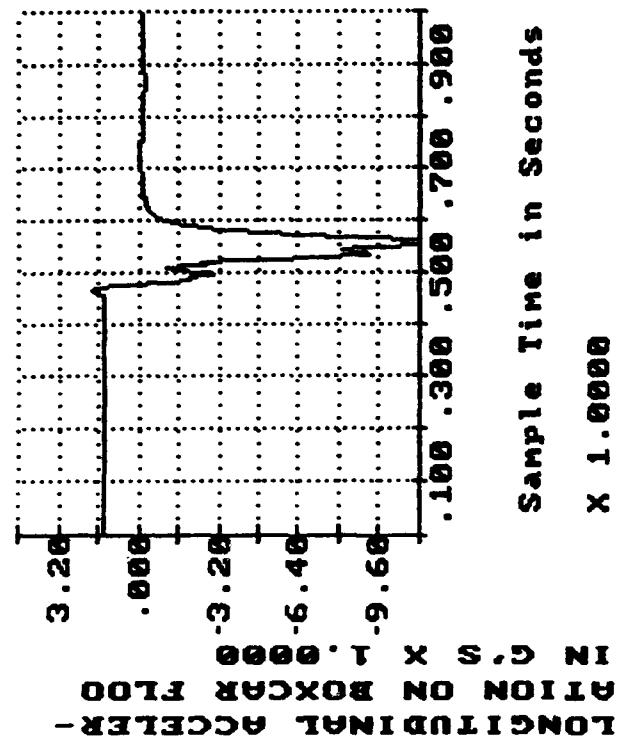
Sample Time in Seconds  
X 1.0000

Sample Time in Seconds  
X 1.0000

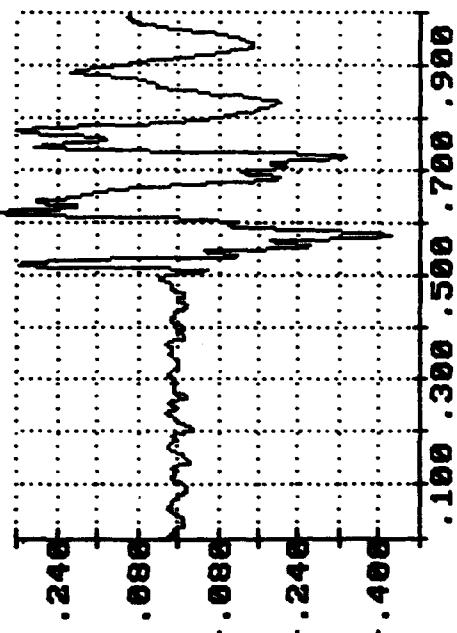
RAIL IMPACT TEST OF ATACMS ON FLATRACK  
DATE: 13 JULY 1989  
SPEED: 4.29 MPH



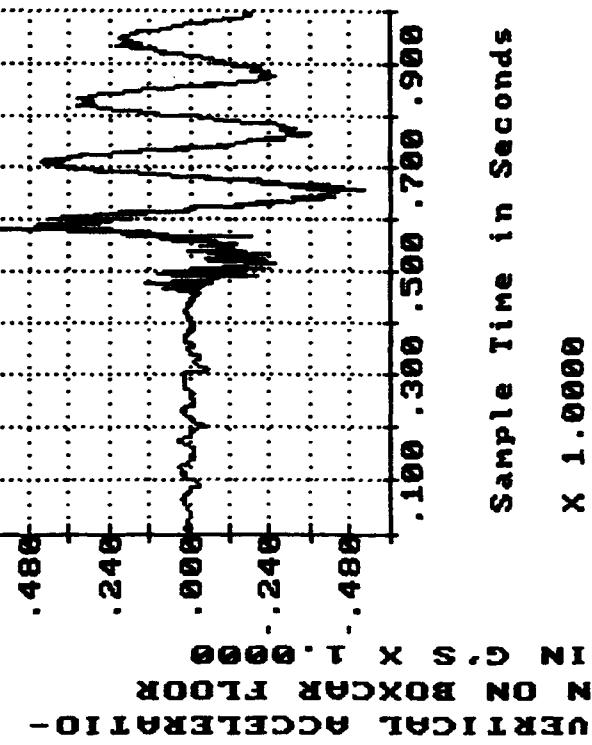
Sample Time in Seconds  
X 1.0000



Sample Time in Seconds  
X 1.0000

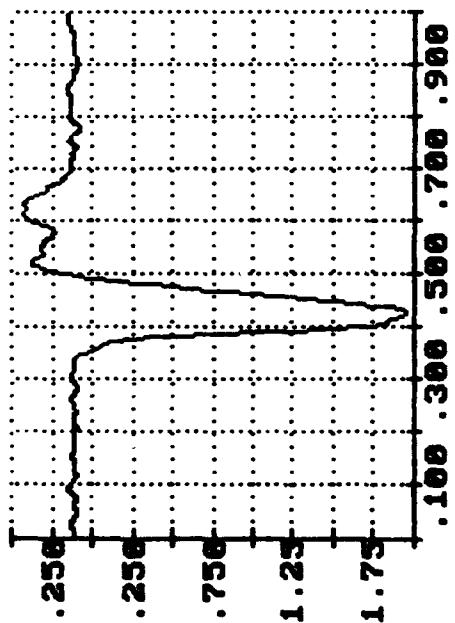


Sample Time in Seconds  
X 1.0000

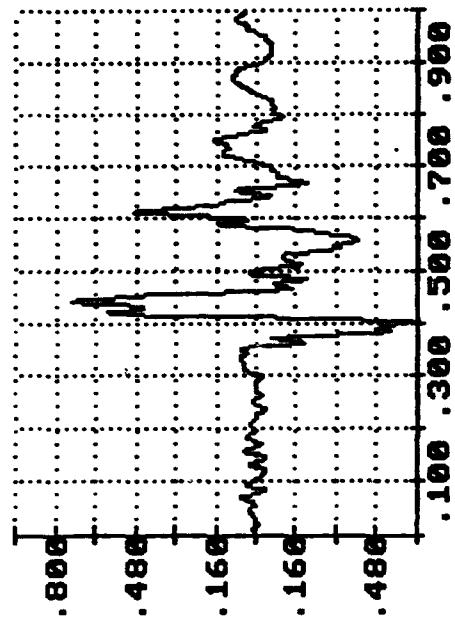


Sample Time in Seconds  
X 1.0000

RAIL IMPACT TEST OF ATTACS ON FLATRACK  
DATE: 13 JULY 1989  
SPEED: 6.38 MPH



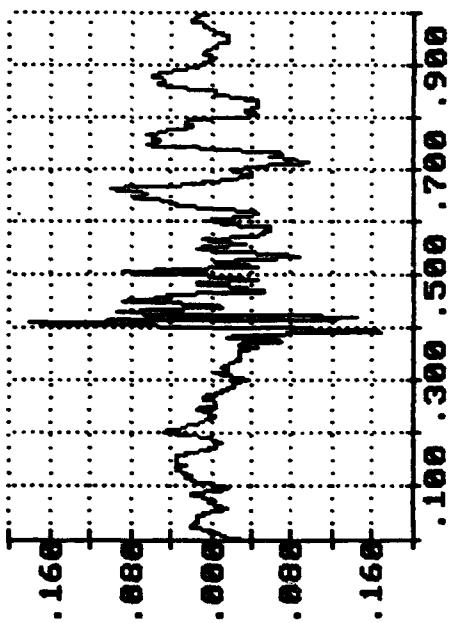
LATERAL ACCELERATION -  
ON FORWARD BLOCK  
ATTION ON FORWARD BLOCK  
IN G.S X 1.0000



VERTICAL ACCELERATION -  
ON FORWARD BLOCK  
ATTION ON FORWARD BLOCK  
IN G.S X 1.0000

Sample Time in Seconds

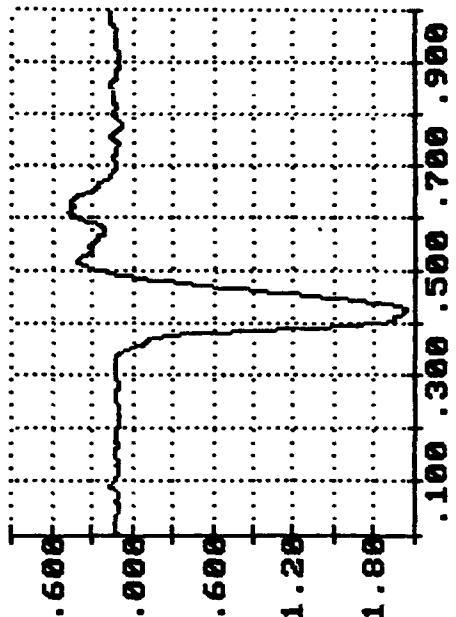
X 1.0000



LATERAL ACCELERATION -  
ON FORWARD BLOCK  
ATTION ON FORWARD BLOCK  
IN G.S X 1.0000

Sample Time in Seconds

X 1.0000



LONGITUDINAL ACCELERATION -  
ATTION ON MIDDLE BLOCK  
ATTION ON MIDDLE BLOCK  
IN G.S X 1.0000

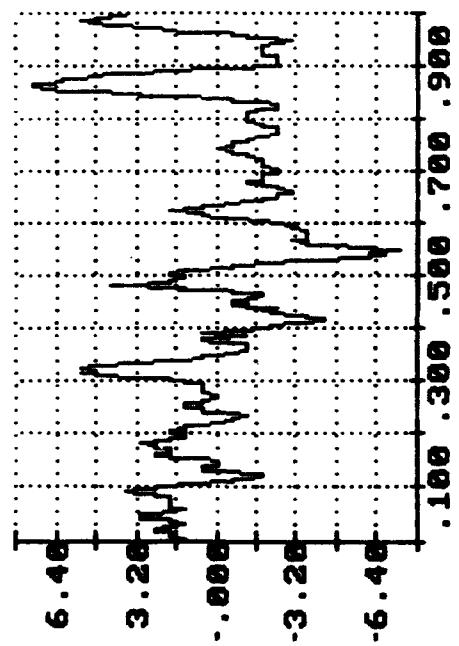
Sample Time in Seconds

X 1.0000

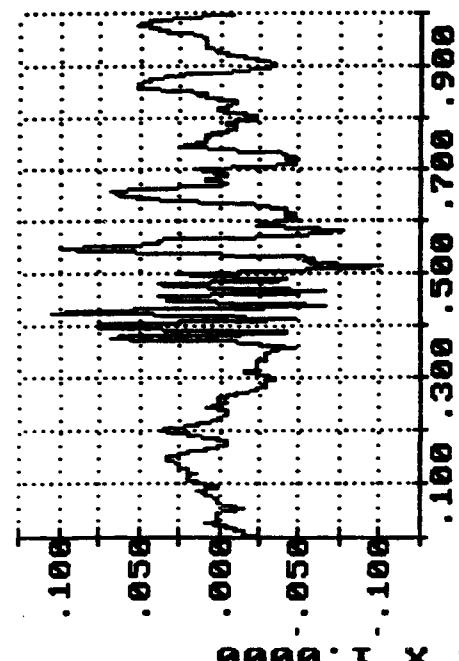
Sample Time in Seconds

X 1.0000

RAIL IMPACT TEST OF ATTACHS ON FLAT TRACK  
DATE: 13 JULY 1989  
SPEED: 6.38 MPH

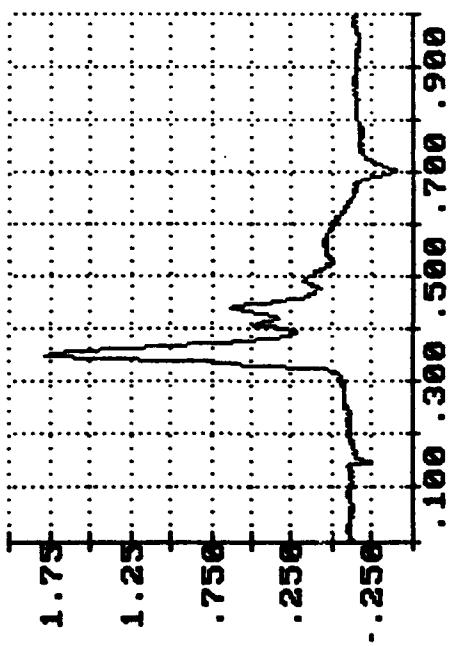


LATERAL ACCELERATION - ON MIDDLE BLOCK IN POUNDS X 1,000,000.0000 IN G.S X .0100



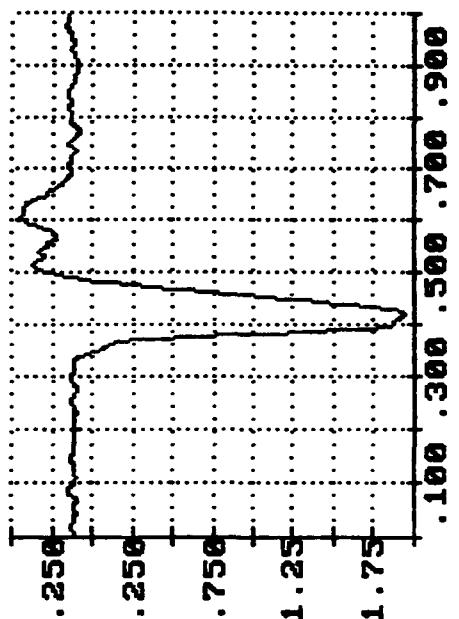
VERTICAL ACCELERATION - IN ON MIDDLE BLOCK IN G.S X 1.0000

Sample Time in Seconds  
X 1.0000



LONGITUDINAL ACCELERATION - IN ON MIDDLE BLOCK IN G.S X 1.0000

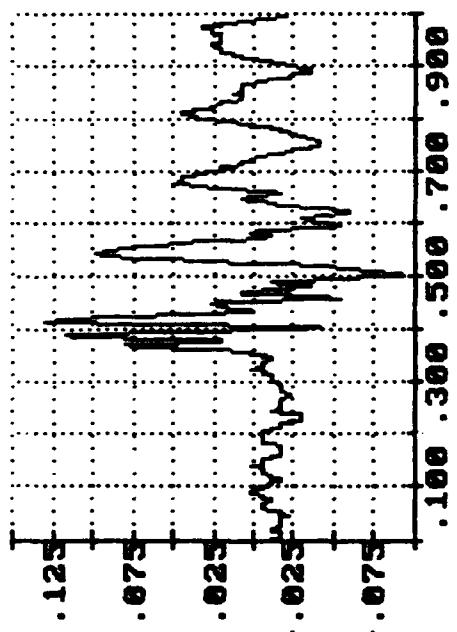
Sample Time in Seconds  
X 1.0000



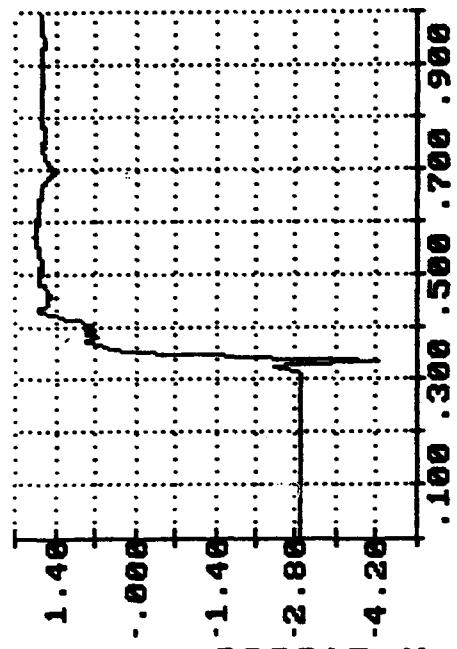
VERTICAL ACCELERATION - IN ON MIDDLE BLOCK IN G.S X 1.0000

Sample Time in Seconds  
X 1.0000

RAIL IMPACT TEST OF ATACMS ON FLATRACK  
DATE: 13 JULY 1989  
SPEED: 6.38 MPH

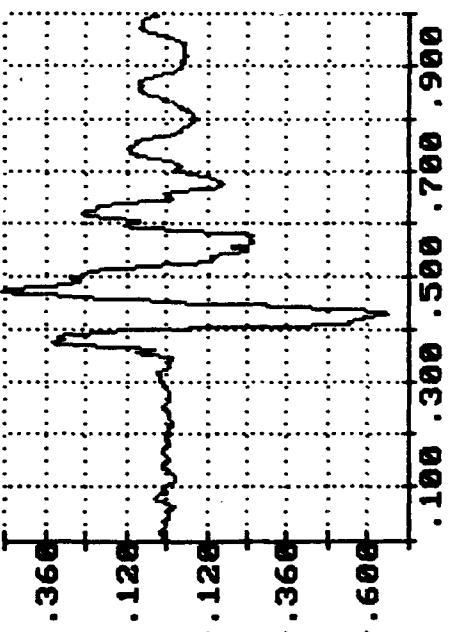


IN G'S X 1.0000  
ON REAR BLOCK  
LATERAL ACCELERATION -

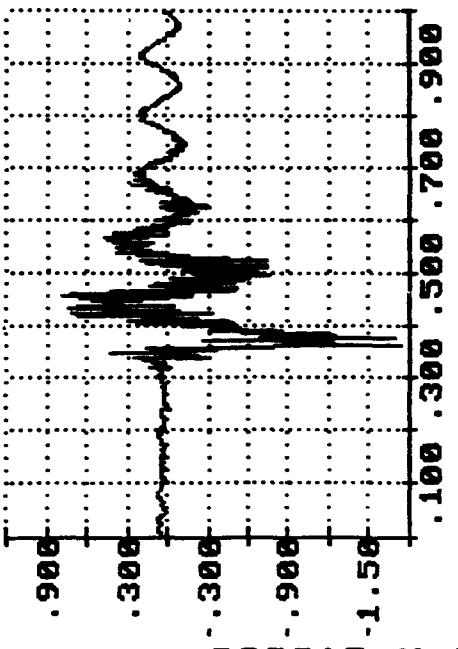


IN G'S X 1.0000  
ON BOXCAR FLOOR  
LONGITUDINAL ACCELERATION -

Sample Time in Seconds  
X 1.0000

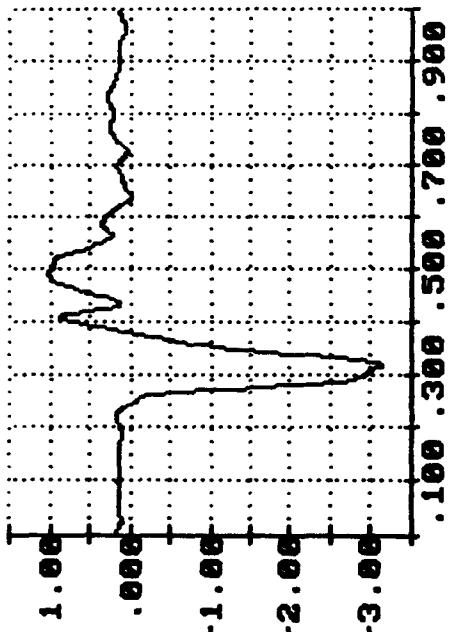


IN G'S X 1.0000  
ON REAR BLOCK  
VERTICAL ACCELERATION -

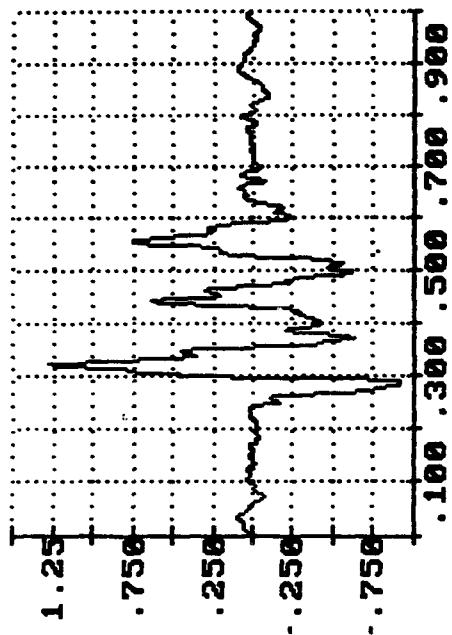


IN G'S X 1.0000  
ON BOXCAR FLOOR  
VERTICAL ACCELERATION -

XAIL IMPACT TEST OF ATACMS ON FLATRACK  
DATE: 13 JULY 1989  
SPEED: 8.43 MPH



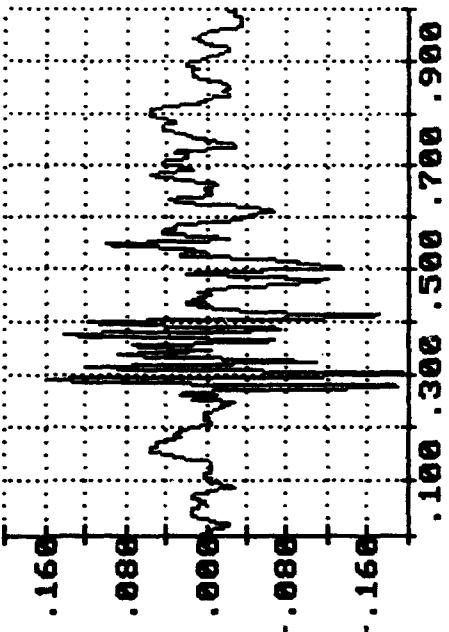
LONGITUDINAL ACCELERATION  
ON FORWARD BLOCK



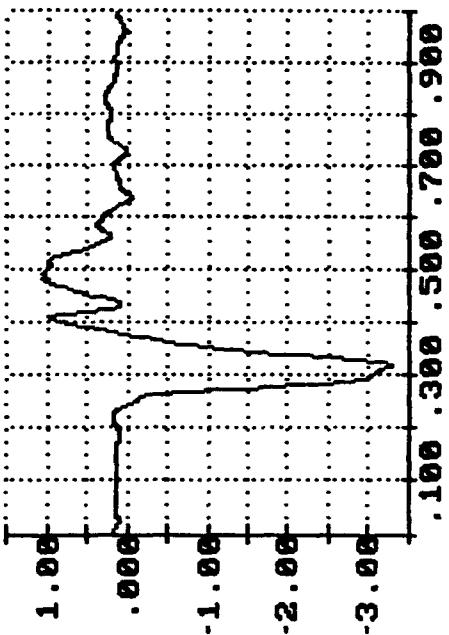
VERTICAL ACCELERATION  
ON FORWARD BLOCK

Sample Time in Seconds

X 1.0000



LATERAL ACCELERATION  
ON FORWARD BLOCK

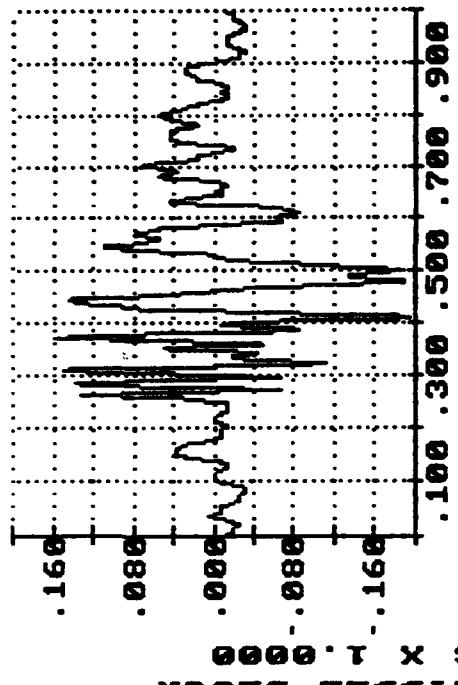


LONGITUDINAL ACCELERATION  
ON MIDDLE BLOCK

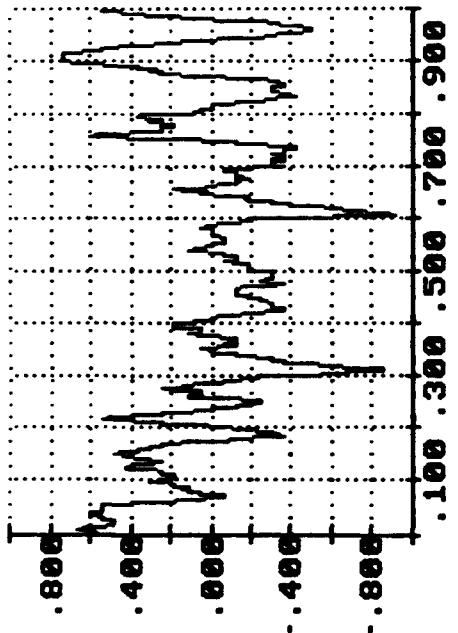
Sample Time in Seconds

X 1.0000

RAIL IMPACT TEST OF ATTACHS ON FLATRACK  
DATE: 13 JULY 1989  
SPEED: 8.43 MPH



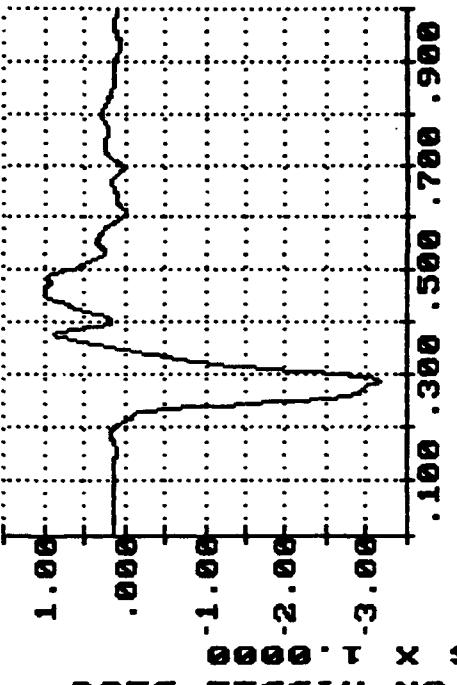
VERTICAL ACCELERATION  
IN ON MIDDLE BLOCK



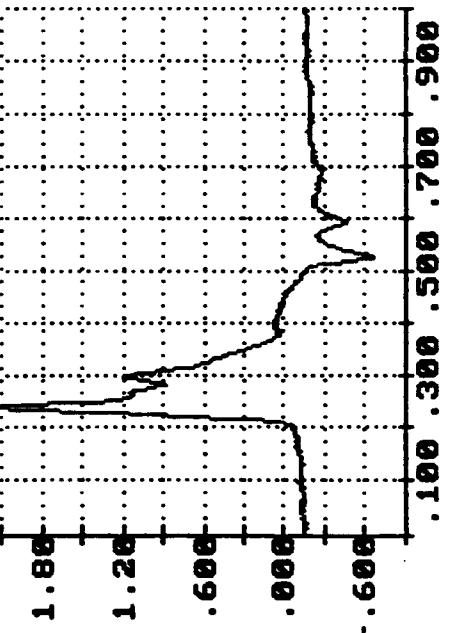
LATERAL ACCELERATION  
ON MIDDLE BLOCK

IN POUNDS X 1000000.0000 IN G'S X .1000

Sample Time in Seconds  
X 1.0000



LONGITUDINAL ACCELERATION  
ATTION ON MIDDLE BLOCK

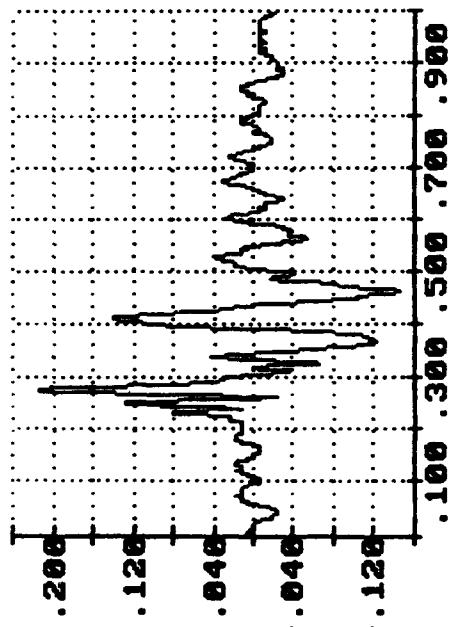


RAIL COUPLER FORCE  
IN POUNDS X 1000000.0000 IN G'S X .1000

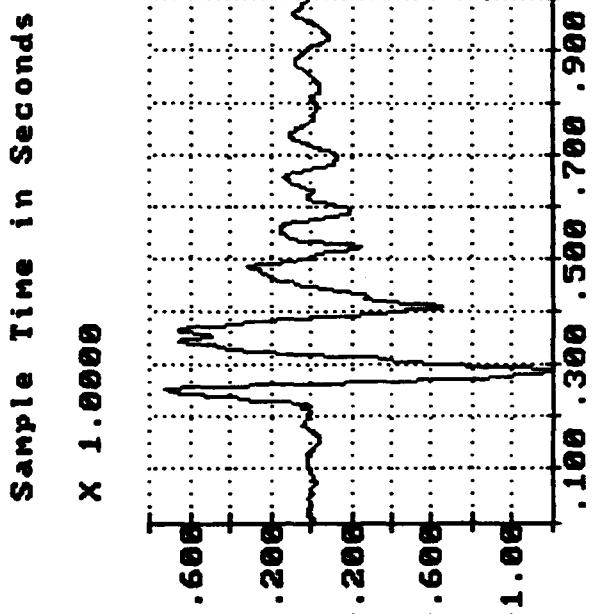
Sample Time in Seconds  
X 1.0000

RAIL IMPACT TEST OF ATTACHES ON FLATRACK

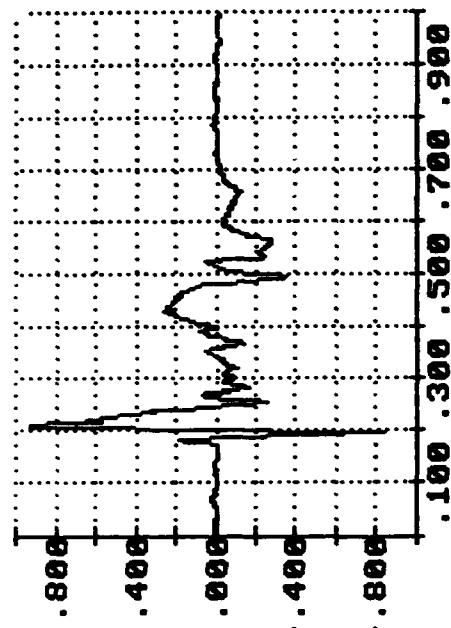
DATE: 13 JULY 1989  
SPEED: 8.43 MPH



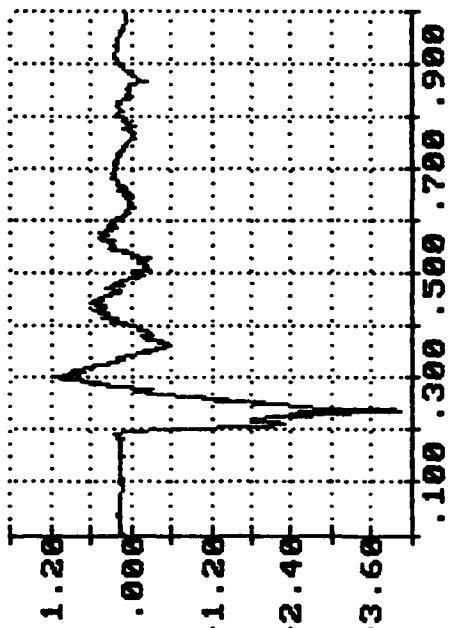
LATERAL ACCELERATION -  
ON REAR BLOCK  
IN G'S X 1.0000



IN G.S X 1.0000  
N ON REAR BLOCK  
OVERTICAL ACCELERATIO-



LONGITUDINAL ACCCELERATION ON BOXCAR FLOOR IN G'S X 1.0000

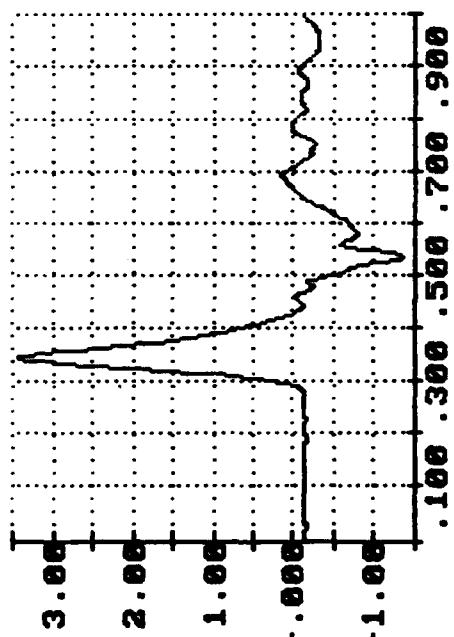


IN G.S X 1.0000  
N ON BOXCAR FLOOR  
-VERTICAL ACCCELERATION

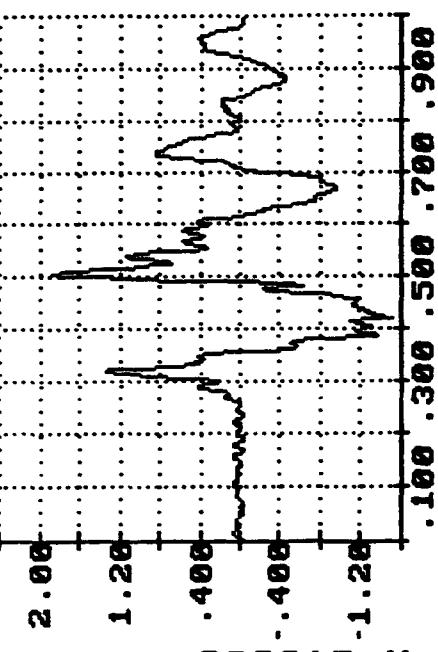
### Sample Time in Seconds

1.000

RAIL IMPACT TEST OF ATACMS ON FLATRACK  
DATE: 13 JULY 1989  
SPEED: 8.19 MPH (REVERSE)

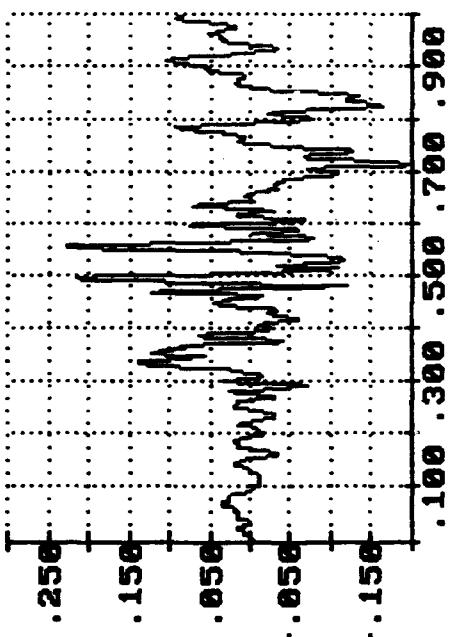


LONGITUDINAL ACCELERATION  
ON FORWARD BLOCK

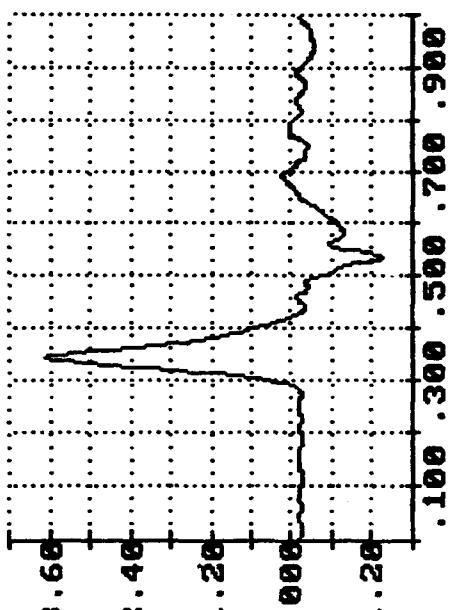


VERTICAL ACCELERATION  
ON FORWARD BLOCK

Sample Time in Seconds  
X 1.0000

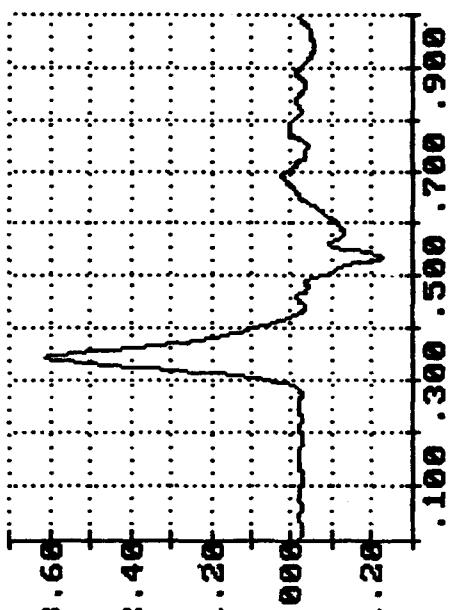


LATERAL ACCELERATION  
ON FORWARD BLOCK



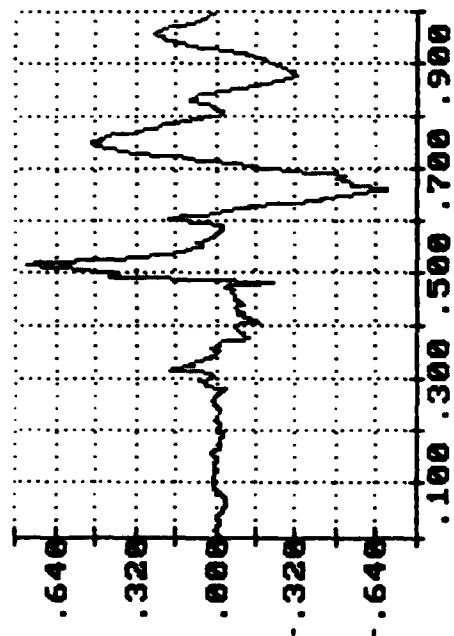
LONGITUDINAL ACCELERATION  
ON MIDDLE BLOCK

Sample Time in Seconds  
X 1.0000

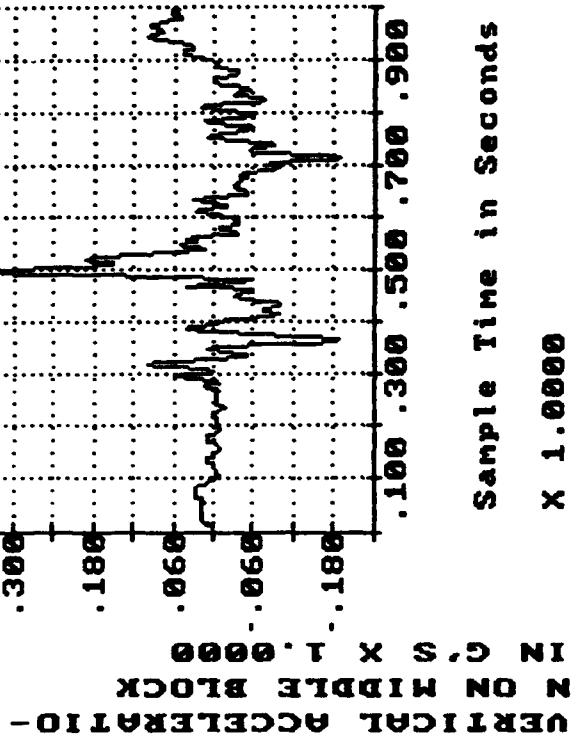


VERTICAL ACCELERATION  
ON MIDDLE BLOCK

RAIL IMPACT TEST OF ATTACHS ON FLATRACK  
DATE: 13 JULY 1989  
SPEED: 8.19 MPH (REVERSE)

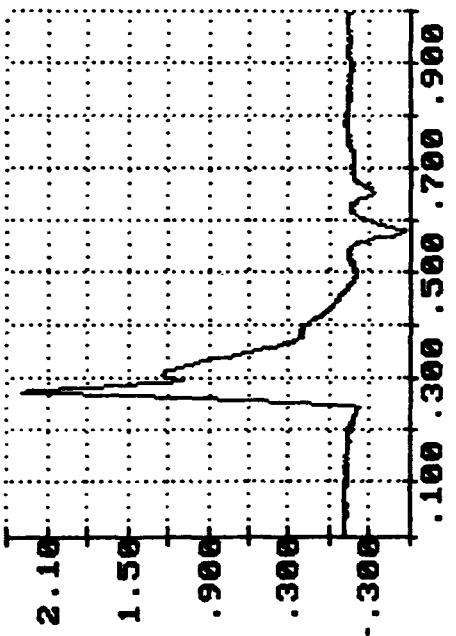


LATERAL ACCELERATION  
ON MIDDLE BLOCK  
IN POUNDS X 1000000.0000



VERTICAL ACCELERATION  
ON MIDDLE BLOCK  
IN G'S X 1.0000

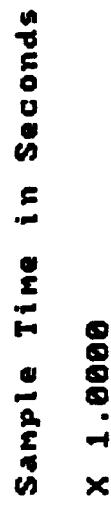
Sample Time in Seconds  
x 1.0000



LONGITUDINAL ACCELERATION  
ON MIDDLE BLOCK  
IN POUNDS X 1000000.0000

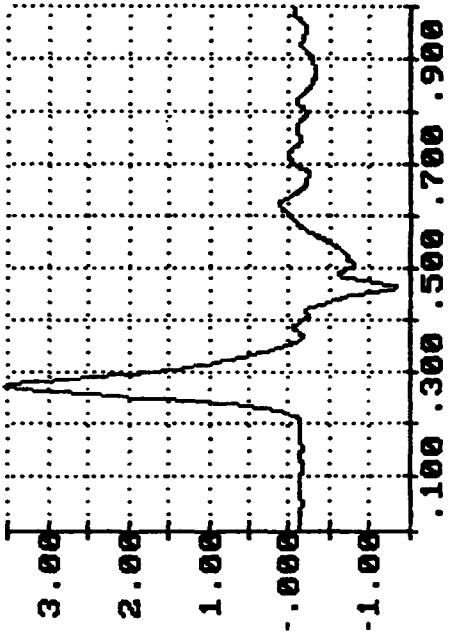


RAIL COUPLER FORCE  
IN POUNDS X 1000000.0000



LONGITUDINAL ACCELERATION  
ON MIDDLE BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
x 1.0000

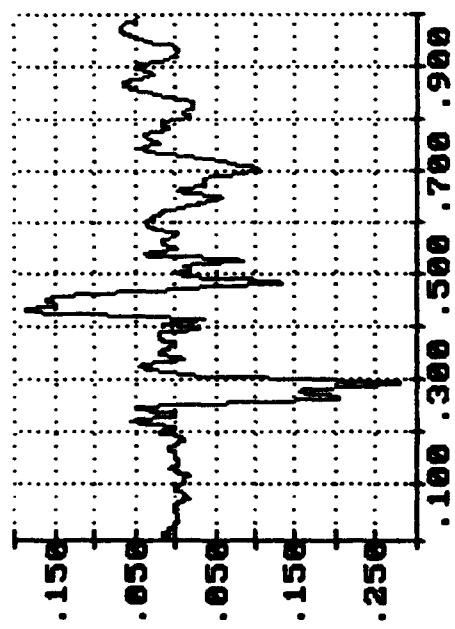


LONGITUDINAL ACCELERATION  
ON MIDDLE BLOCK  
IN G'S X 1.0000

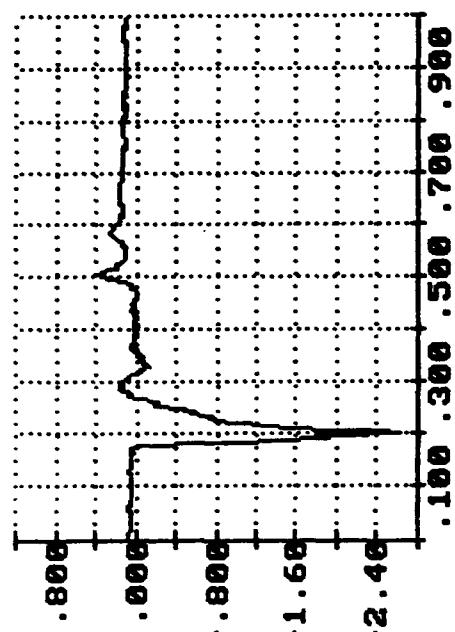
RAIL IMPACT TEST OF ATOMCS ON FLATBED

SPEED: 8.19 MPH (REVERSE)

DATE: 13 JULY 1986



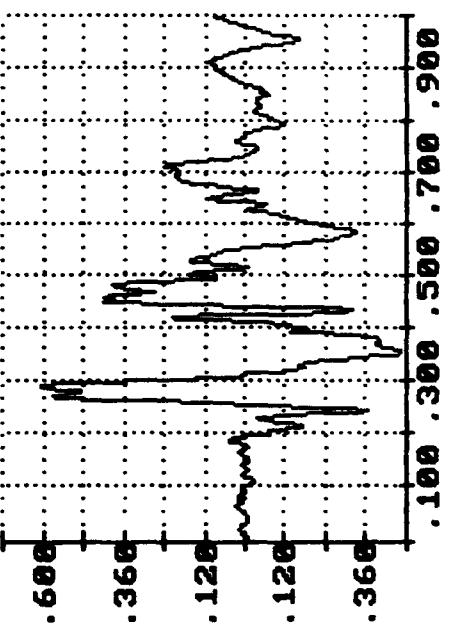
LATERAL ACCELERATION  
ON REAR BLOCK  
IN G'S X 1.0000



LONGITUDINAL ACCELERATION  
IN G'S X 1.0000

Sample Time in Seconds

X 1.0000

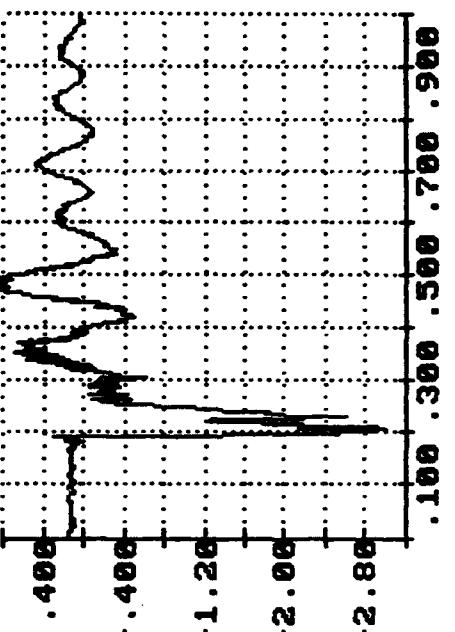


VERTICAL ACCELERATION  
ON REAR BLOCK  
IN G'S X 1.0000

VERTICAL ACCELERATION  
ON REAR BLOCK  
IN G'S X 1.0000

Sample Time in Seconds

X 1.0000



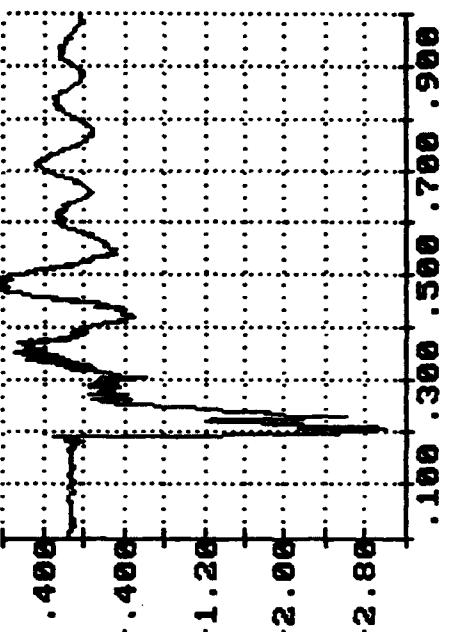
VERTICAL ACCELERATION  
IN G'S X 1.0000

Sample Time in Seconds

X 1.0000

Sample Time in Seconds

X 1.0000



LONGITUDINAL ACCELERATION  
IN G'S X 1.0000

LONGITUDINAL ACCELERATION  
IN G'S X 1.0000

ROAD TEST DATA

TEST NO: 9

DATE: 14 JULY 1989

TEST SPECIMEN: ATACMS on a Flatrack

PASS 1-A OVER FIRST SERIES OF TIES: 0.10 MIN 5.68 MPH

PASS 1-B OVER SECOND SERIES OF TIES: 0.10 MIN 5.68 MPH

REMARKS: No damage.

PASS 2-A OVER FIRST SERIES OF TIES: 0.10 MIN 5.68 MPH

PASS 2-B OVER SECOND SERIES OF TIES: 0.10 MIN 5.68 MPH

REMARKS: No damage.

30 MILE ROAD TEST: No shifting or damage to load.

PANIC STOP TEST: Not performed.

PASS 3-A OVER FIRST SERIES OF TIES: 0.10 MIN 5.68 MPH

PASS 3-B OVER SECOND SERIES OF TIES: 0.10 MIN 5.68 MPH

REMARKS: No damage.

PASS 4-A OVER FIRST SERIES OF TIES: 0.10 MIN 5.68 MPH

PASS 4-B OVER SECOND SERIES OF TIES: 0.10 MIN 5.68 MPH

REMARKS: No damage.

WASHBOARD COURSE: Two passes, load intact without damage.

RESULTS FROM ROAD HAZARD TESTING OF  
 ATACMS ON FLATRACK  
 DATE: 14 JULY 1989

TAPE CHANNEL 1 : LONGITUDINAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	-1.54	65.74	.0655
PASS 1, COURSE B	8.00	-1.08	64.58	.0482
PASS 2, COURSE A	8.00	-.97	70.71	.0432
PASS 2, COURSE B	8.00	-1.03	64.60	.0474
PASS 3, COURSE A	8.00	-1.33	77.30	.0496
PASS 3, COURSE B	8.00	-1.00	70.17	.0430
PASS 4, COURSE A	8.00	-1.38	66.41	.0545
PASS 4, COURSE B	8.00	-1.04	70.54	.0527
WASHBOARD COURSE	8.00	.92	61.69	.0383

TAPE CHANNEL 2 : LATERAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	1.55	110.08	.1155
PASS 1, COURSE B	8.00	-.79	81.61	.0484
PASS 2, COURSE A	8.00	-1.36	40.96	.0333
PASS 2, COURSE B	8.00	-.79	48.84	.0270
PASS 3, COURSE A	8.00	-1.58	115.43	.1173
PASS 3, COURSE B	8.00	.91	95.68	.0597
PASS 4, COURSE A	8.00	-1.66	136.37	.1299
PASS 4, COURSE B	8.00	.85	131.83	.0808
WASHBOARD COURSE	8.00	-.40	20.72	.0036

TAPE CHANNEL 3 : VERTICAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	3.42	46.43	.1075
PASS 1, COURSE B	8.00	1.79	63.14	.0641
PASS 2, COURSE A	8.00	3.14	46.16	.1004
PASS 2, COURSE B	8.00	1.82	75.25	.0932
PASS 3, COURSE A	8.00	3.39	51.17	.1212
PASS 3, COURSE B	8.00	1.83	59.96	.0770
PASS 4, COURSE A	8.00	3.42	47.39	.1092
PASS 4, COURSE B	8.00	1.93	57.36	.0764
WASHBOARD COURSE	8.00	2.55	34.23	.0494

TAPE CHANNEL 4 : LONGITUDINAL ACCELERATION ON MIDDLE BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	-1.49	64.09	.0604
PASS 1, COURSE B	8.00	-1.04	61.24	.0445
PASS 2, COURSE A	8.00	-.93	64.89	.0395
PASS 2, COURSE B	8.00	.99	55.68	.0354
PASS 3, COURSE A	8.00	-1.29	69.68	.0484
PASS 3, COURSE B	8.00	-1.05	70.23	.0435
PASS 4, COURSE A	8.00	-1.36	63.54	.0498
PASS 4, COURSE B	8.00	-1.07	60.40	.0456
WASHBOARD COURSE	8.00	1.08	64.84	.0452

TAPE CHANNEL 5 : LATERAL ACCELERATION ON MIDDLE BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	1.74	78.88	.0895
PASS 1, COURSE B	8.00	.03	43.40	.0008
PASS 2, COURSE A	8.00	.09	46.68	.0031
PASS 2, COURSE B	8.00	-.04	47.60	.0013
PASS 3, COURSE A	8.00	2.01	63.69	.0943
PASS 3, COURSE B	8.00	1.10	134.72	.0475
PASS 4, COURSE A	8.00	1.99	65.43	.0920
PASS 4, COURSE B	8.00	1.13	106.85	.0688
WASHBOARD COURSE	8.00	1.76	81.55	.0908

TAPE CHANNEL 7 : VERTICAL ACCELERATION ON MIDDLE BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	-1.38	153.50	.1317
PASS 1, COURSE B	8.00	.95	215.78	.1271
PASS 2, COURSE A	8.00	1.37	149.01	.1051
PASS 2, COURSE B	8.00	1.01	190.84	.1291
PASS 3, COURSE A	8.00	-1.41	138.92	.1239
PASS 3, COURSE B	8.00	1.04	723.07	.0684
PASS 4, COURSE A	8.00	-1.48	108.11	.1048
PASS 4, COURSE B	8.00	1.05	171.67	.1121
WASHBOARD COURSE	8.00	.32	20.72	.0030

TAPE CHANNEL 8 : LONGITUDINAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	-1.46	63.38	.0598
PASS 1, COURSE B	8.00	-.98	61.12	.0412
PASS 2, COURSE A	8.00	-.90	66.54	.0396
PASS 2, COURSE B	8.00	-.92	72.22	.0393
PASS 3, COURSE A	8.00	-1.25	70.45	.0470
PASS 3, COURSE B	8.00	-.98	69.14	.0408
PASS 4, COURSE A	8.00	-1.32	70.83	.0483
PASS 4, COURSE B	8.00	-1.00	59.60	.0426
WASHBOARD COURSE	8.00	.96	67.23	.0419

TAPE CHANNEL 9 : LATERAL ACCELERATION ON REAR BLOCK

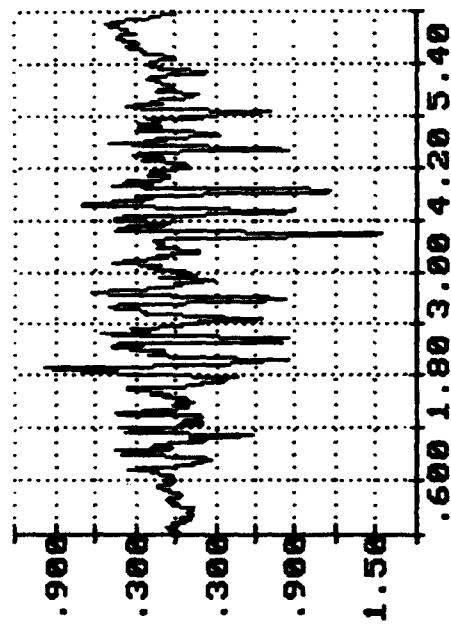
TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	-.76	135.88	.0657
PASS 1, COURSE B	8.00	.49	134.18	.0452
PASS 2, COURSE A	8.00	.50	83.54	.0301
PASS 2, COURSE B	8.00	.50	139.08	.0492
PASS 3, COURSE A	8.00	.71	111.19	.0569
PASS 3, COURSE B	8.00	.50	156.71	.0510
PASS 4, COURSE A	8.00	.80	85.82	.0495
PASS 4, COURSE B	8.00	.55	104.14	.0400
WASHBOARD COURSE	8.00	-.18	73.37	.0080

TAPE CHANNEL 10 : VERTICAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	.81	83.82	.0446
PASS 1, COURSE B	8.00	.89	61.32	.0393
PASS 2, COURSE A	8.00	.81	128.00	.0471
PASS 2, COURSE B	8.00	.96	52.35	.0339
PASS 3, COURSE A	8.00	.85	117.55	.0484
PASS 3, COURSE B	8.00	.93	52.40	.0330
PASS 4, COURSE A	8.00	.89	233.64	.0074
PASS 4, COURSE B	8.00	.90	83.54	.0470
WASHBOARD COURSE	8.00	1.25	50.53	.0405

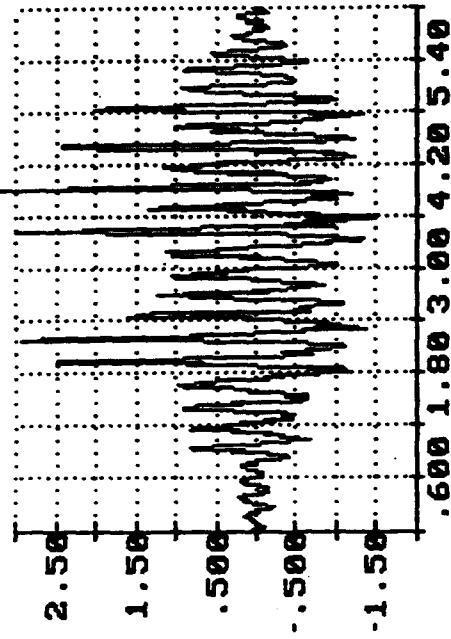
ROAD HAZARD TEST OF ATTACHS ON FLATRACK

DATE: 14 JULY 1989  
PASS 1, COURSE A



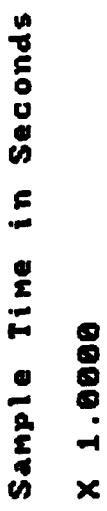
LONGITUDINAL ACCELERATION  
ON FORWARD BLOCK

IN G.S X 1.0000



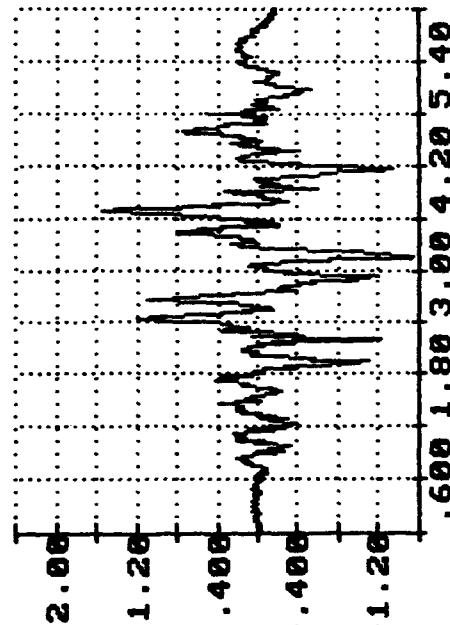
LONGITUDINAL ACCELERATION  
ON MIDDLE BLOCK

IN G.S X 1.0000



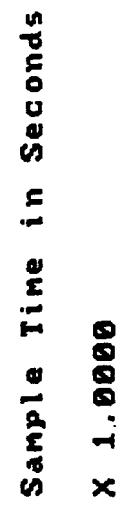
LATERAL ACCELERATION  
ON FORWARD BLOCK

IN G.S X 1.0000



LATERAL ACCELERATION  
ON FORWARD BLOCK

IN G.S X 1.0000



LONGITUDINAL ACCELERATION  
ON MIDDLE BLOCK

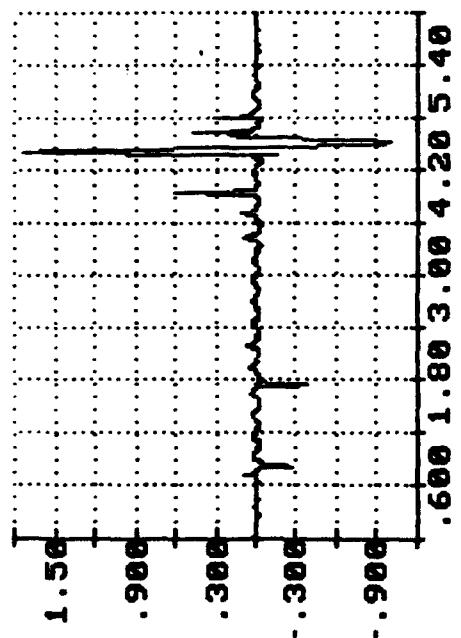
IN G.S X 1.0000



LONGITUDINAL ACCELERATION  
ON MIDDLE BLOCK

IN G.S X 1.0000

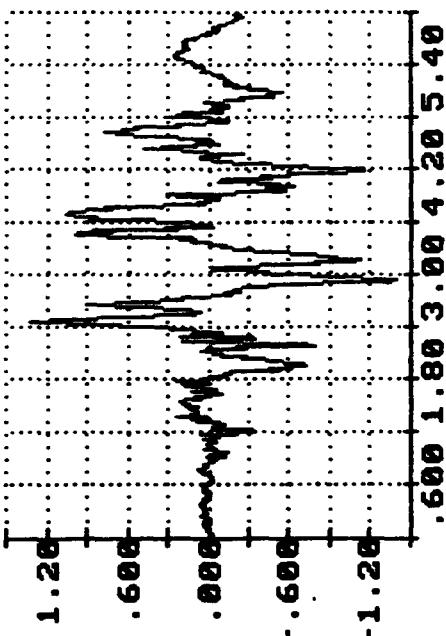
ROAD HAZARD TEST OF ATTACHS ON FLATRACK  
DATE: 14 JULY 1989  
PASS 1, COURSE A



LATERAL ACCELERATION  
ON MIDDLE BLOCK

IN G.S X 1.0000

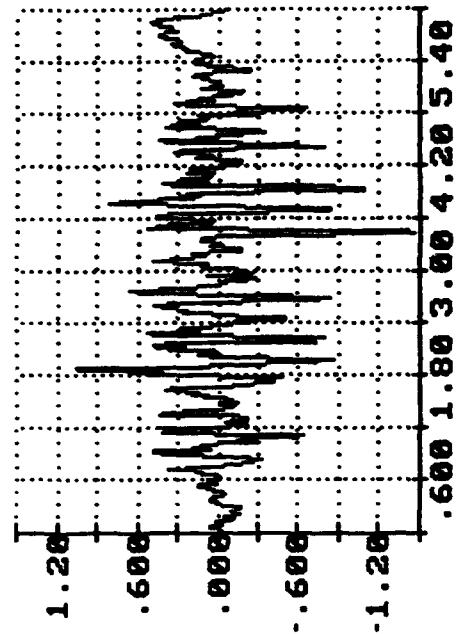
Sample Time in Seconds  
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IN G.S X 1.0000

LATERAL ACCELERATION  
ON REAR BLOCK

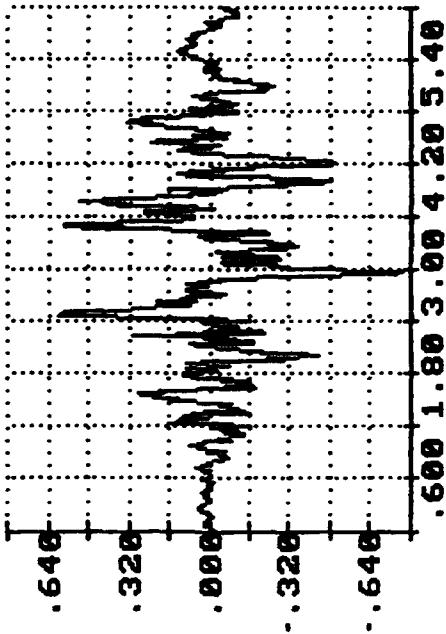
Sample Time in Seconds  
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LONGITUDINAL ACCELERATION  
ON MIDDLE BLOCK

IN G.S X 1.0000

Sample Time in Seconds  
 $\times 1.0000$

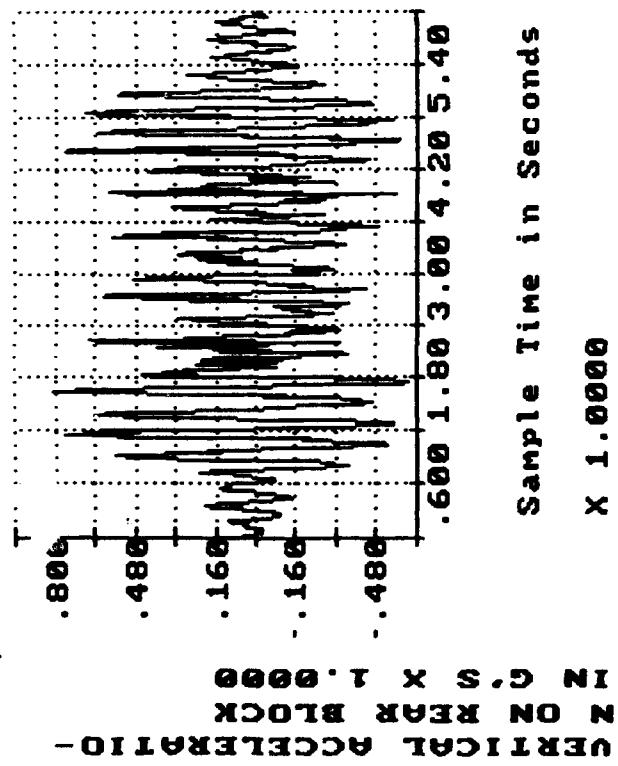


IN G.S X 1.0000

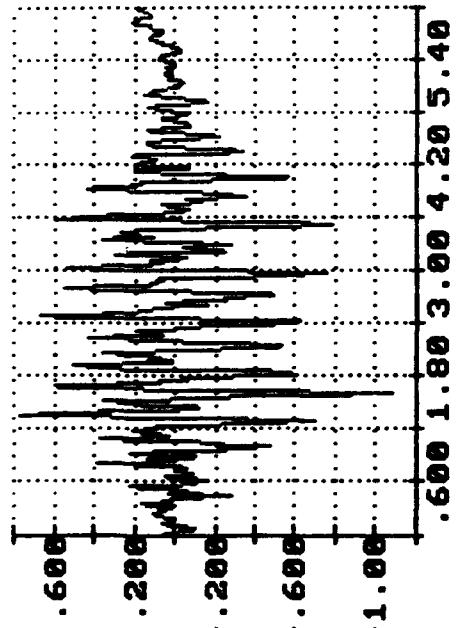
LONGITUDINAL ACCELERATION  
ON REAR BLOCK

Sample Time in Seconds  
 $\times 1.0000$

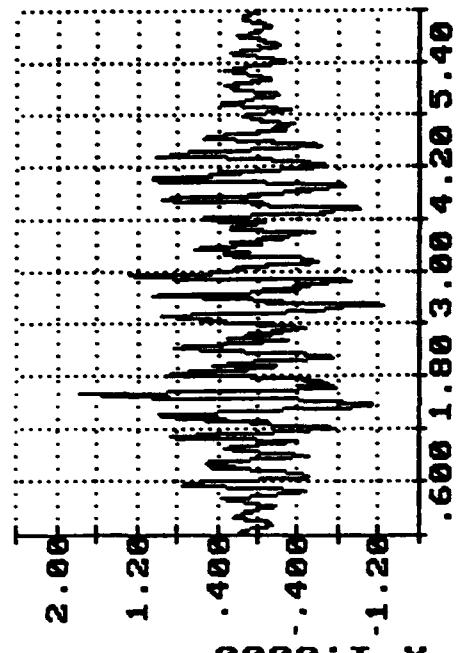
ROAD HAZARD TEST OF ATTACHS ON FLATRACK  
DATE: 14 JULY 1989  
PASS 1, COURSE A



ROAD HAZARD TEST OF ATTACHS ON FLATRACK  
DATE: 14 JULY 1989  
PASS 1, COURSE B



LONGITUDINAL ACCELERATION  
ATTION ON FORWARD BLOCK



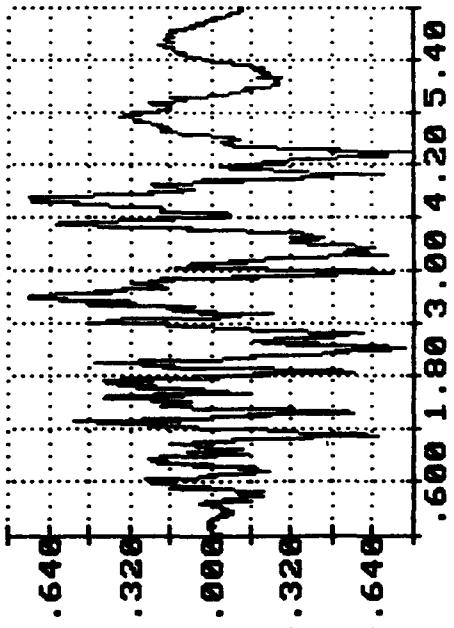
VERTICAL ACCELERATION  
IN ON FORWARD BLOCK

Sample Time in Seconds  
X 1.0000

X 1.0000

Sample Time in Seconds  
X 1.0000

X 1.0000



LATERAL ACCELERATION  
ON FORWARD BLOCK

LATERAL ACCELERATION  
ATTION ON FORWARD BLOCK

Sample Time in Seconds  
X 1.0000

X 1.0000

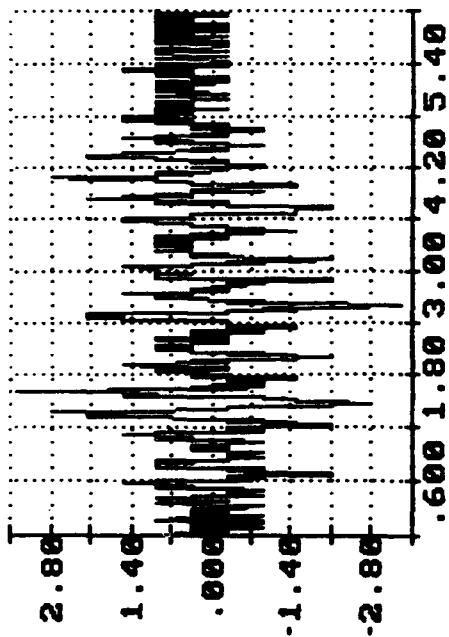
Sample Time in Seconds  
X 1.0000

X 1.0000

Sample Time in Seconds  
X 1.0000

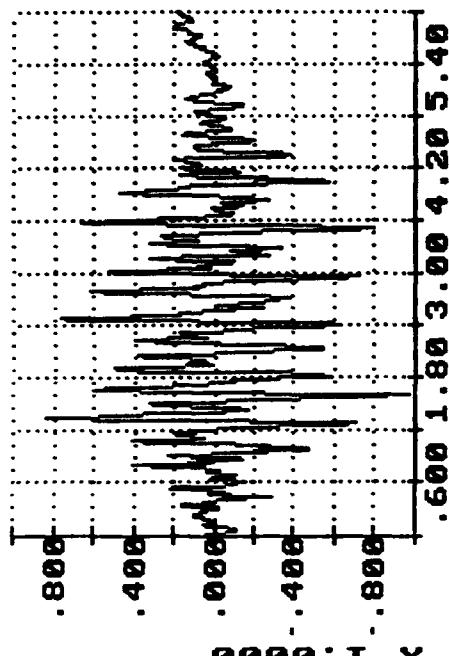
X 1.0000

ROAD HAZARD TEST OF ATTACHS ON FLATPACK  
DATE: 14 JULY 1989  
PASS 1, COURSE B



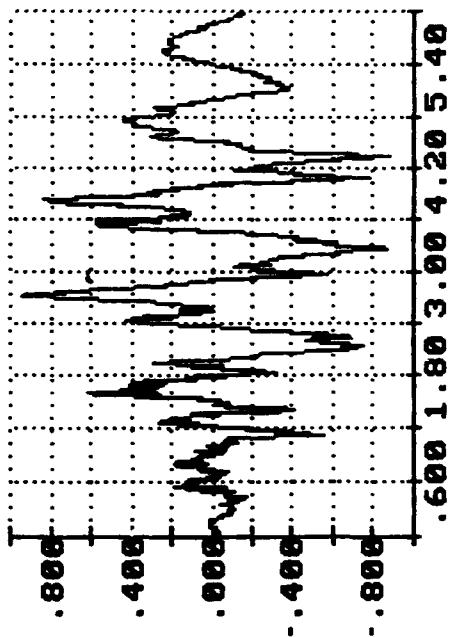
LATERAL ACCELERATION-  
ON MIDDLE BLOCK  
IN G.S X .0100

Sample Time in Seconds  
X 1.0000



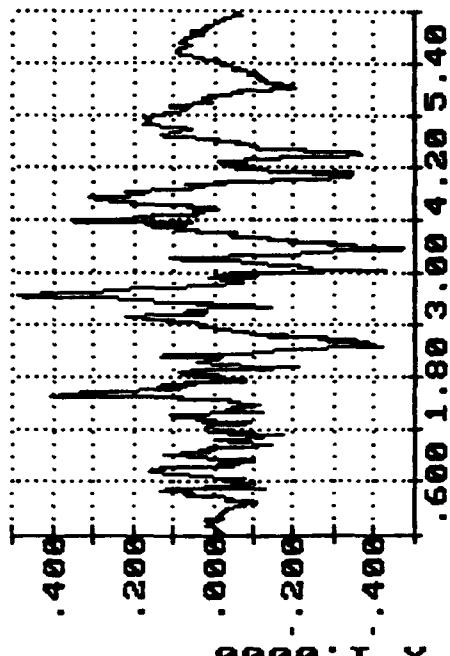
LONGITUDINAL ACCELERATION-  
ATTACH ON MIDDLE BLOCK  
IN G.S X 1.0000

Sample Time in Seconds  
X 1.0000



VERTICAL ACCELERATION-  
ON MIDDLE BLOCK  
IN G.S X 1.0000

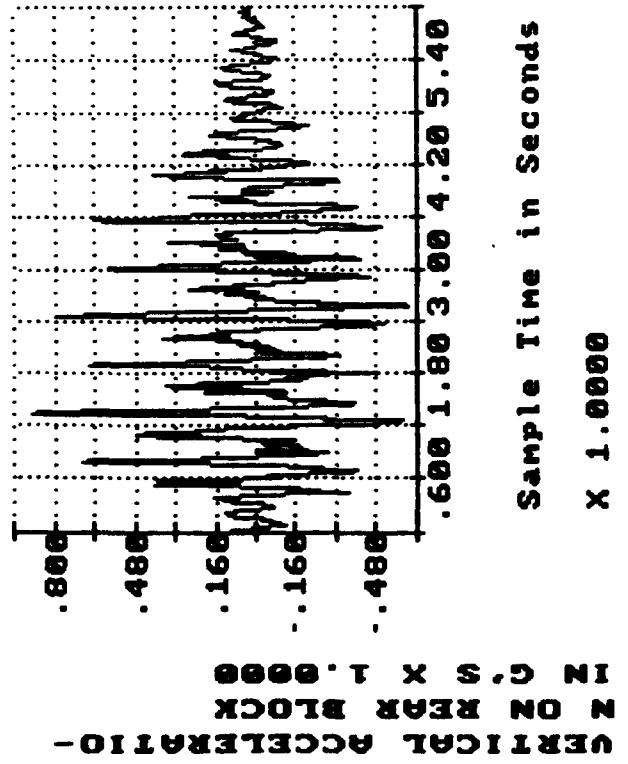
Sample Time in Seconds  
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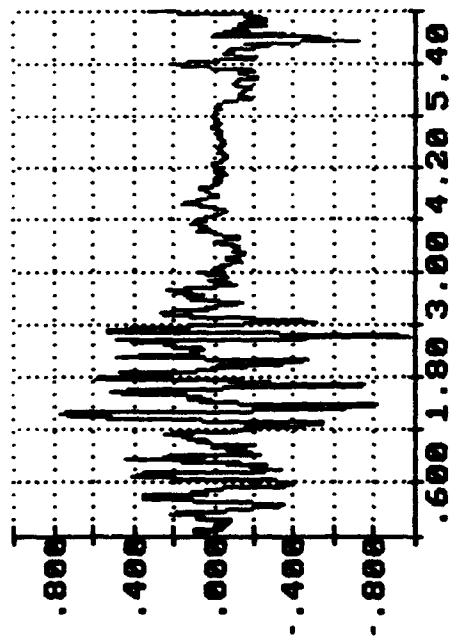
LATERAL ACCELERATION-  
ON REAR BLOCK  
IN G.S X 1.0000

Sample Time in Seconds  
X 1.0000

ROAD HAZARD TEST OF ATACMS ON FLATTRACK  
DATE: 14 JULY 1989  
PASS 1, COURSE B

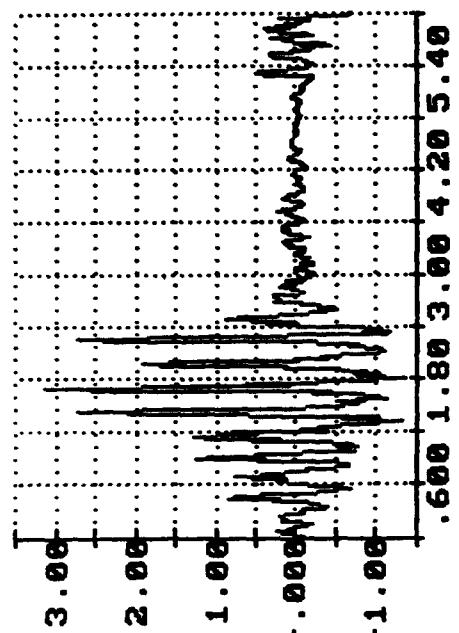


ROAD HAZARD TEST OF ATACMS ON FLATRACK  
DATE: 14 JULY 1989  
PASS 2, COURSE A



LONGITUDINAL ACCELERATION  
ON FORWARD BLOCK  
ACTION ON FORWARD BLOCK

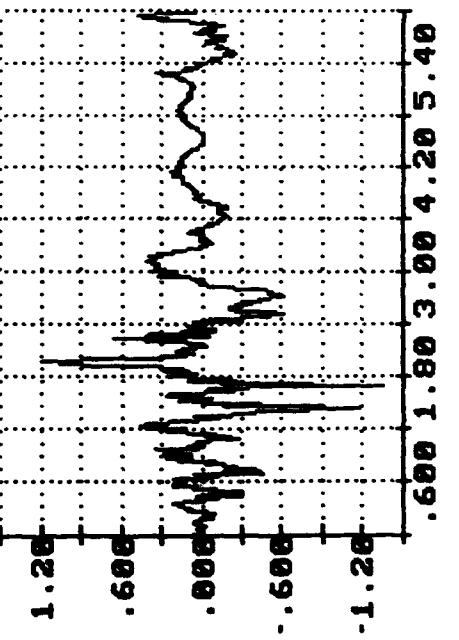
IN G.S X 1.0000



VERTICAL ACCELERATION  
ON FORWARD BLOCK  
ACTION ON FORWARD BLOCK

IN G.S X 1.0000

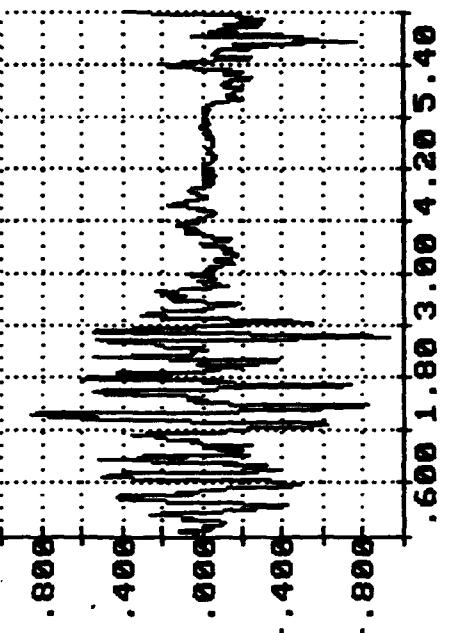
Sample Time in Seconds  
X 1.0000



LATERAL ACCELERATION  
ON FORWARD BLOCK  
ACTION ON FORWARD BLOCK

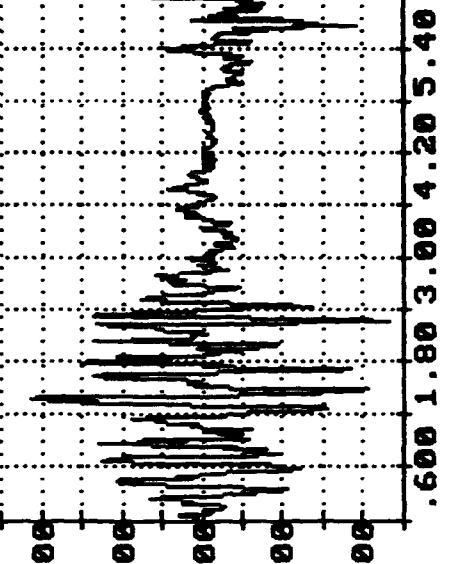
IN G.S X 1.0000

Sample Time in Seconds  
X 1.0000



LONGITUDINAL ACCELERATION  
ON MIDDLE BLOCK  
ACTION ON MIDDLE BLOCK

IN G.S X 1.0000



VERTICAL ACCELERATION  
ON MIDDLE BLOCK  
ACTION ON MIDDLE BLOCK

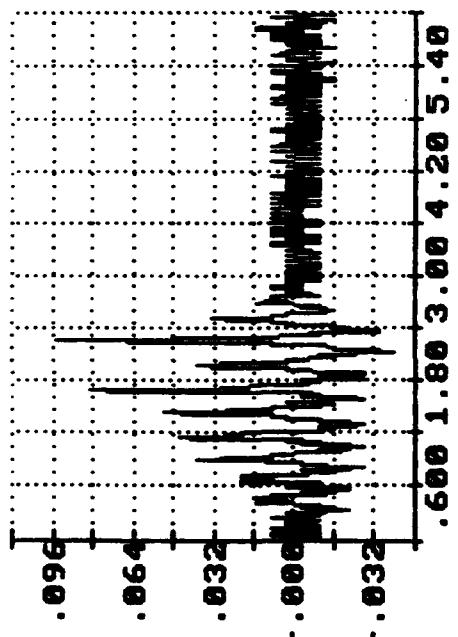
IN G.S X 1.0000

Sample Time in Seconds  
X 1.0000

Sample Time in Seconds  
X 1.0000

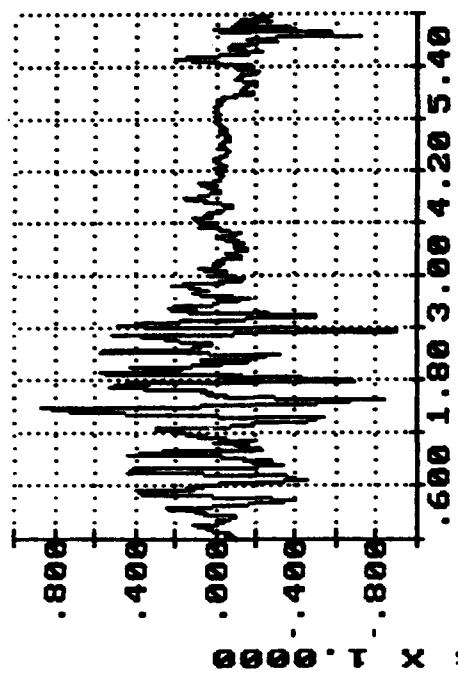
Sample Time in Seconds  
X 1.0000

ROAD HAZARD TEST OF ATTACHS UN FLATRACK  
DATE: 14 JULY 1989  
PASS 2, COURSE A



LATERAL ACCELERATION  
ON MIDDLE BLOCK  
IN G'S X 1.0000

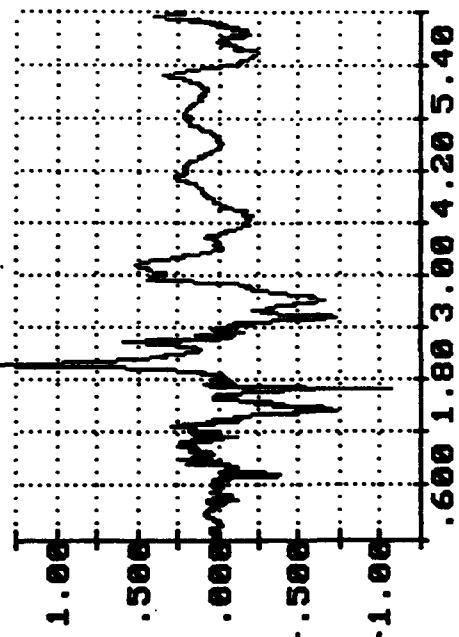
Sample Time in Seconds  
X 1.0000



LONGITUDINAL ACCELERATION  
ON MIDDLE BLOCK  
IN G'S X 1.0000

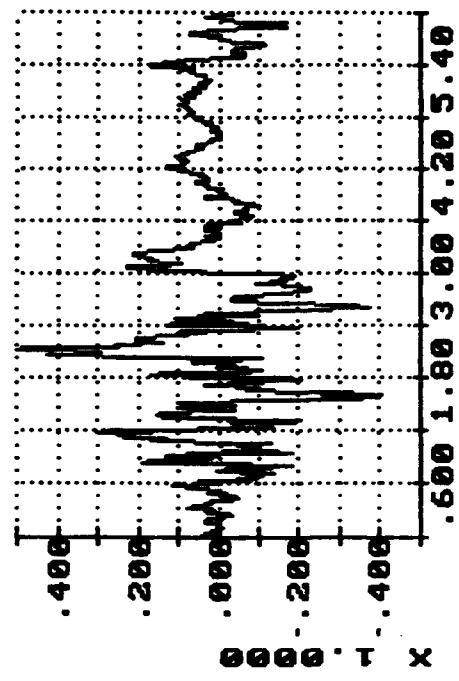
Sample Time in Seconds

X 1.0000



VERTICAL ACCELERATION  
ON MIDDLE BLOCK  
IN G'S X 1.0000

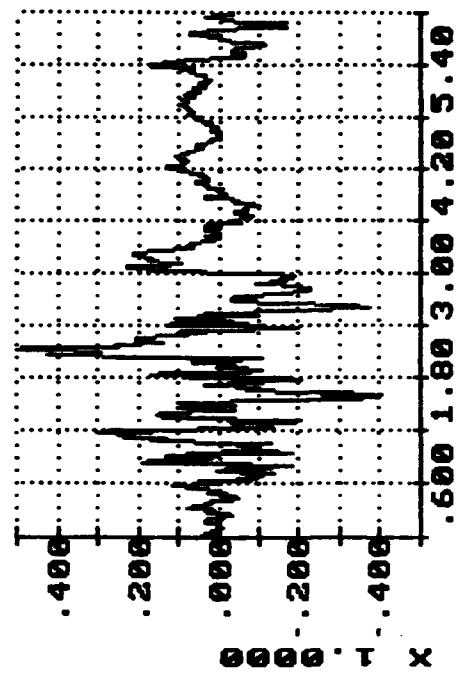
Sample Time in Seconds  
X 1.0000



LATERAL ACCELERATION  
ON REAR BLOCK  
IN G'S X 1.0000

Sample Time in Seconds

X 1.0000

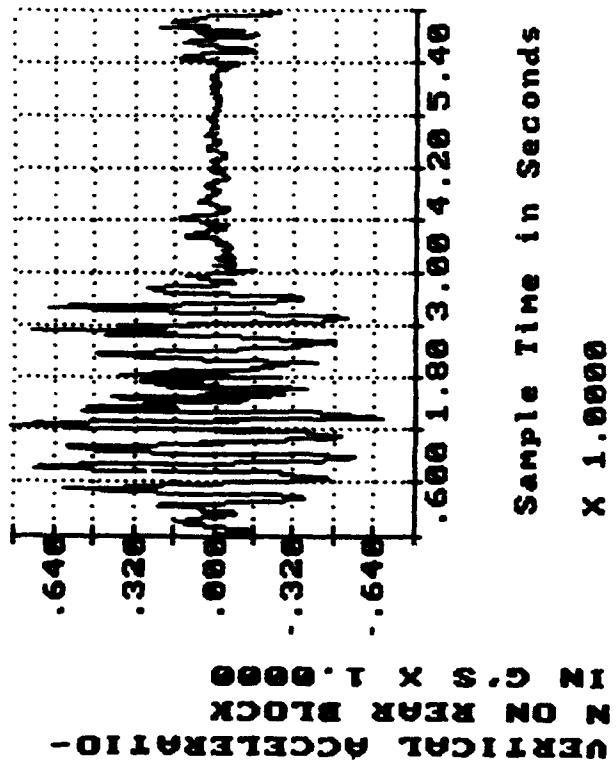


LONGITUDINAL ACCELERATION  
ON REAR BLOCK  
IN G'S X 1.0000

Sample Time in Seconds

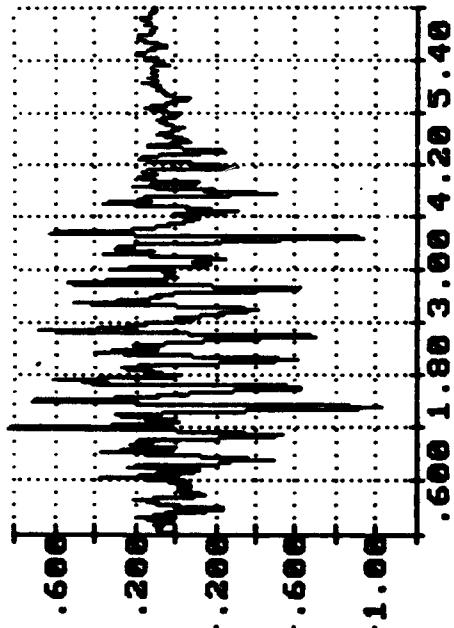
X 1.0000

ROAD HAZARD TEST OF ATTACMS ON FLATTRACK  
DATE: 14 JULY 1989  
PASS 2, COURSE A

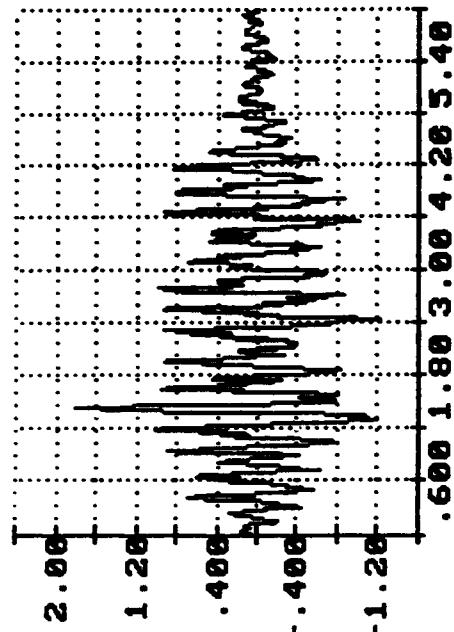


ROAD HAZARD TEST OF ATTACHS ON FLATRACK

DATE: 14 JULY 1989  
PASS 2, COURSE B

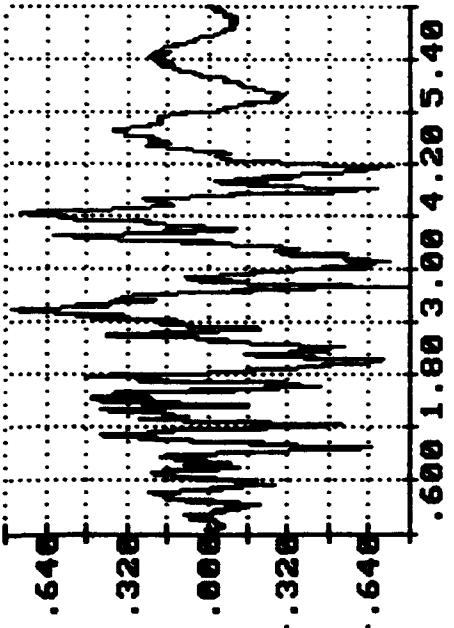


LONGITUDINAL ACCELERATION -  
ATTACH ON FORWARD BLOCK  
IN G'S X 1.0000



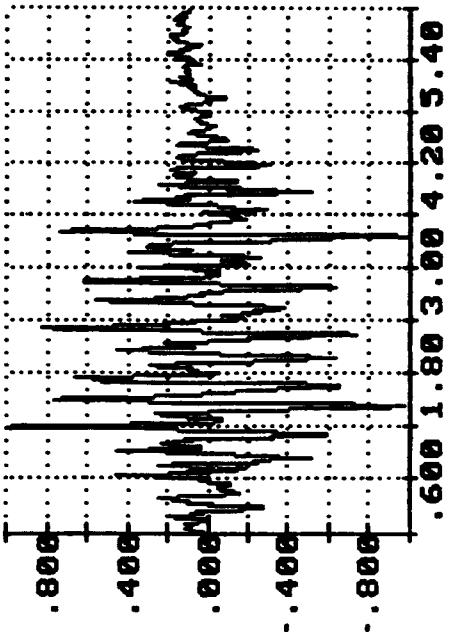
VERTICAL ACCELERATION -  
IN ON FORWARD BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.00000



LATERAL ACCELERATION -  
ON FORWARD BLOCK  
IN G'S X 1.0000

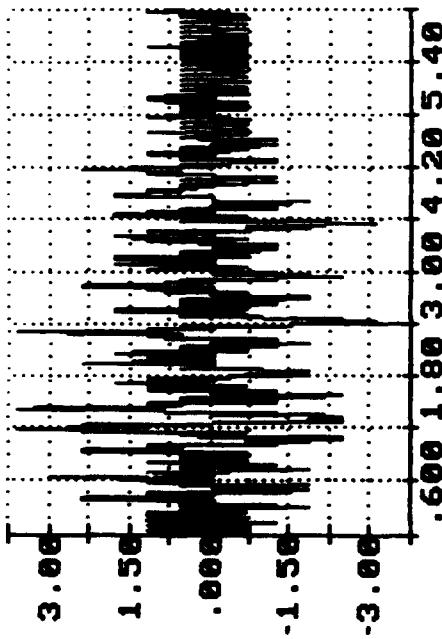
Sample Time in Seconds  
X 1.00000



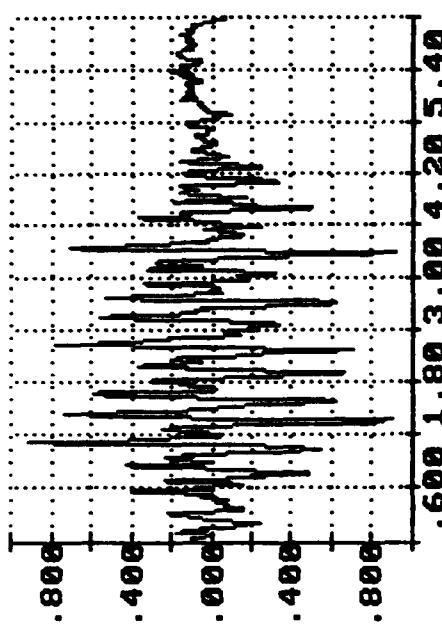
LONGITUDINAL ACCELERATION -  
ATTACH ON MIDDLE BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.00000

ROUND HAZARD TEST ON AIRCRAFT ON FLATWACK  
DATE: 14 JULY 1989  
PASS 2, COURSE B

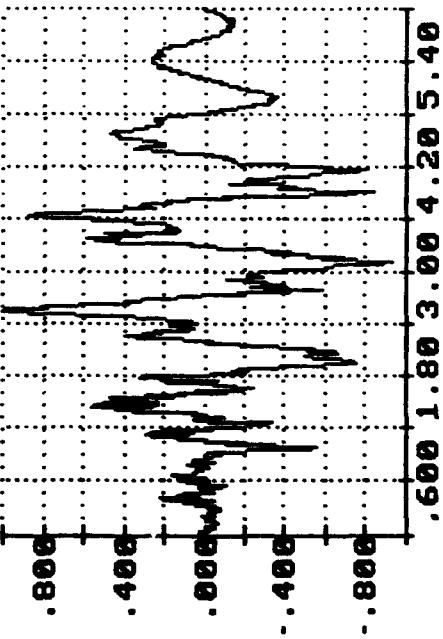


LATERAL ACCELERATION -  
ON MIDDLE BLOCK  
ATION ON MIDDLE BLOCK  
IN G'S X 1.0000



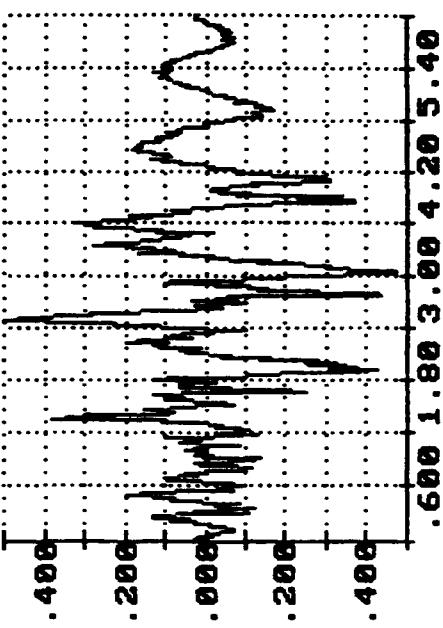
LONGITUDINAL ACCELERATION -  
ON MIDDLE BLOCK  
ATION ON MIDDLE BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
 $\times 1.0000$



VERTICAL ACCELERATION -  
ON MIDDLE BLOCK  
IN G'S X 1.0000

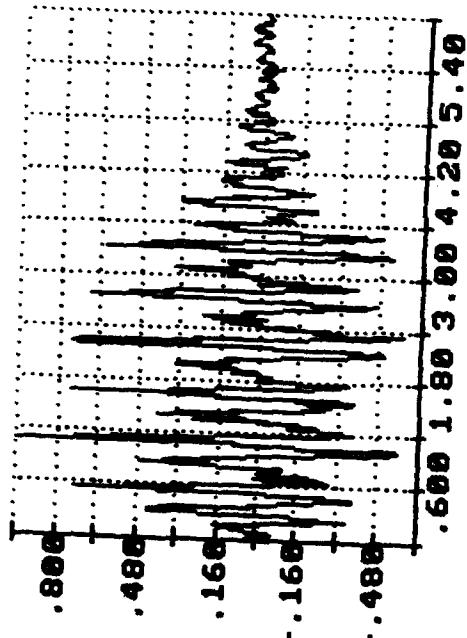
LATERAL ACCELERATION -  
ON REAR BLOCK  
ATION ON REAR BLOCK  
IN G'S X 1.0000



Sample Time in Seconds  
 $\times 1.0000$

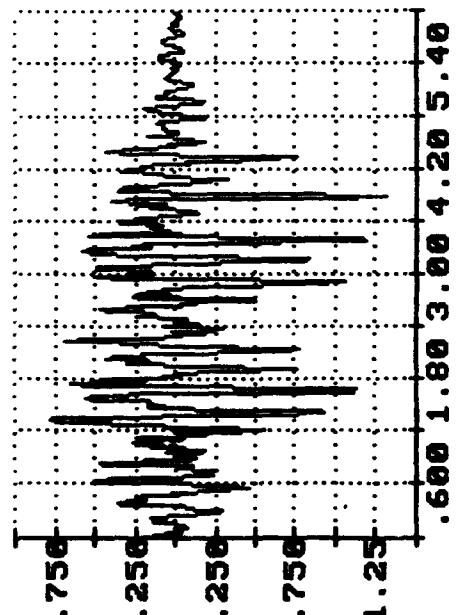
Sample Time in Seconds  
 $\times 1.0000$

ROAD HAZARD TEST OF ATACMS ON FLATRACK  
DATE: 14 JULY 1989  
PASS 2, COURSE B



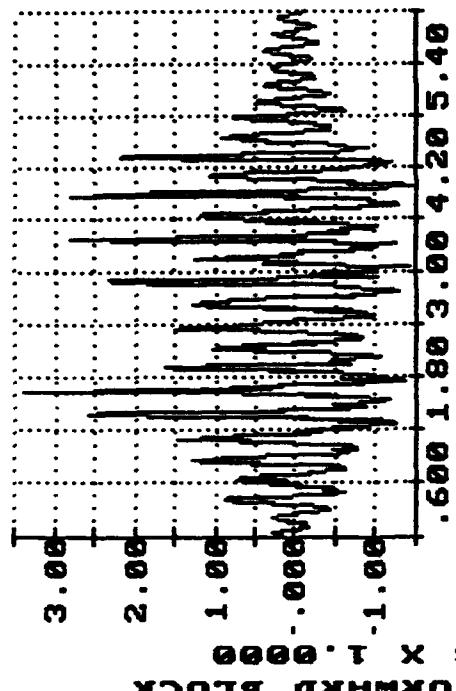
IN ON REAR BLOCK  
-ACCELERATION-

ROAD HAZARD TEST OF ATTACHS ON FLATRACK  
DATE: 14 JULY 1989  
PASS 3, COURSE A



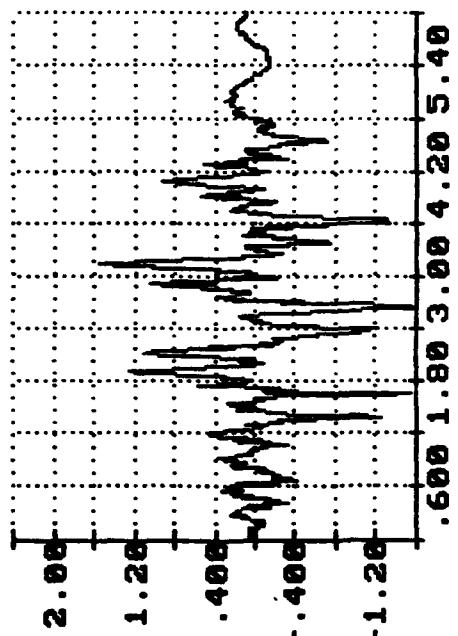
LATERAL ACCELERATION  
ON FORWARD BLOCK  
ACCELERATION  
IN G'S X 1.0000

Sample Time in Seconds  
x 1.0000



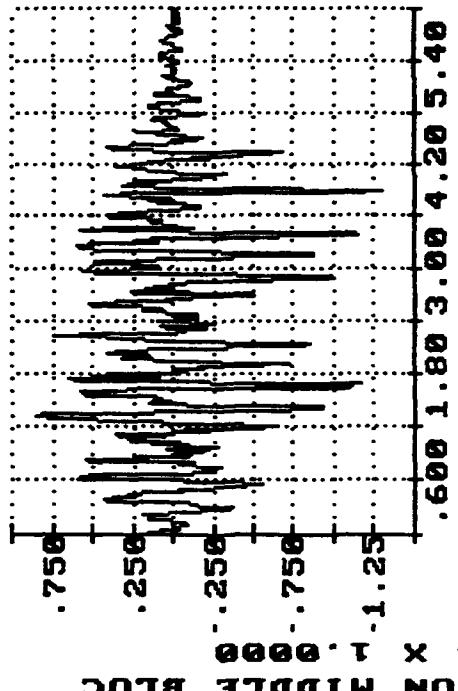
LONGITUDINAL ACCELERATION  
ON FORWARD BLOCK  
ACCELERATION  
IN G'S X 1.0000

Sample Time in Seconds  
x 1.0000



LATERAL ACCELERATION  
ON FORWARD BLOCK  
ACCELERATION  
IN G'S X 1.0000

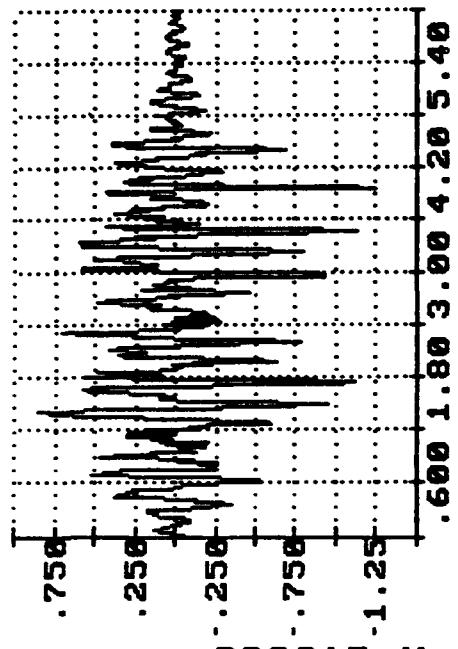
Sample Time in Seconds  
x 1.0000



LONGITUDINAL ACCELERATION  
ON MIDDLE BLOCK  
ACCELERATION  
IN G'S X 1.0000

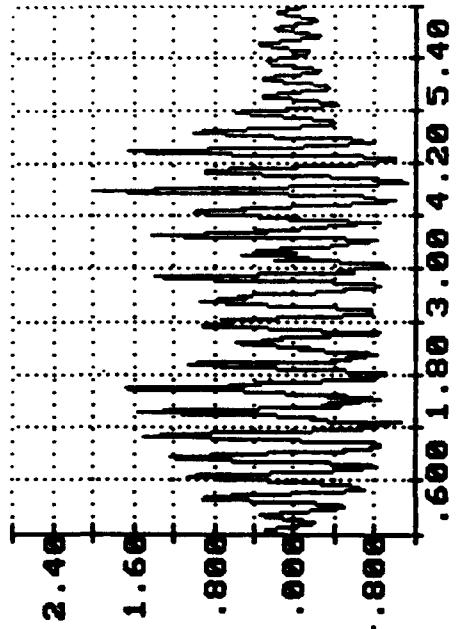
Sample Time in Seconds  
x 1.0000

KUHD HAZARD TEST OF ATTACHS ON FLATRACK  
DATE: 14 JULY 1989  
PASS 3, COURSE A



LATERAL ACCELERATION -  
ON MIDDLE BLOCK

IN G'S X 1.0000



LATERAL ACCELERATION -  
ON MIDDLE BLOCK

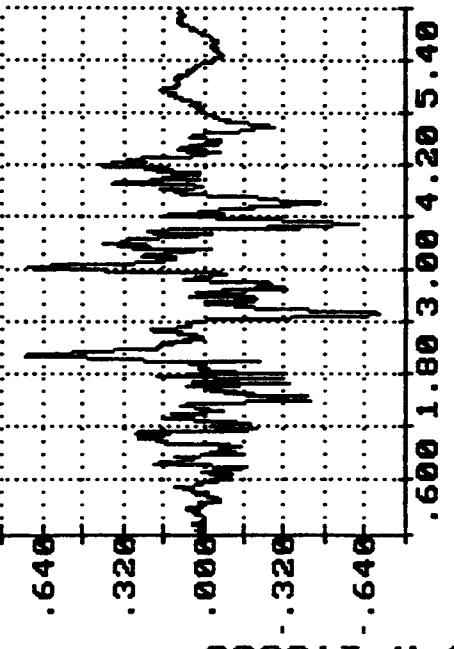
IN G'S X 1.0000

Sample Time in Seconds

x 1.0000

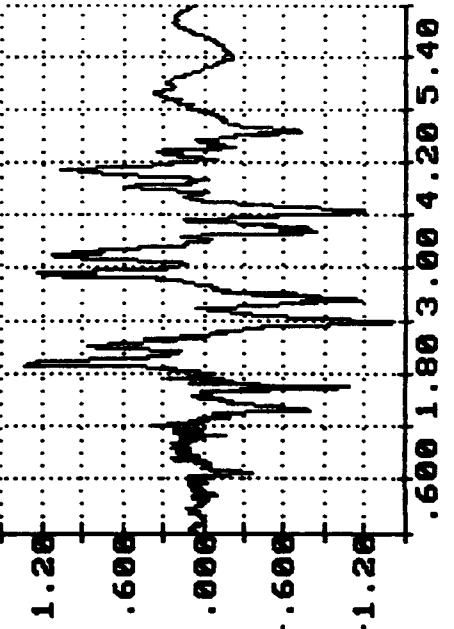
Sample Time in Seconds

x 1.0000



LONGITUDINAL ACCELERATION -  
ON MIDDLE BLOCK

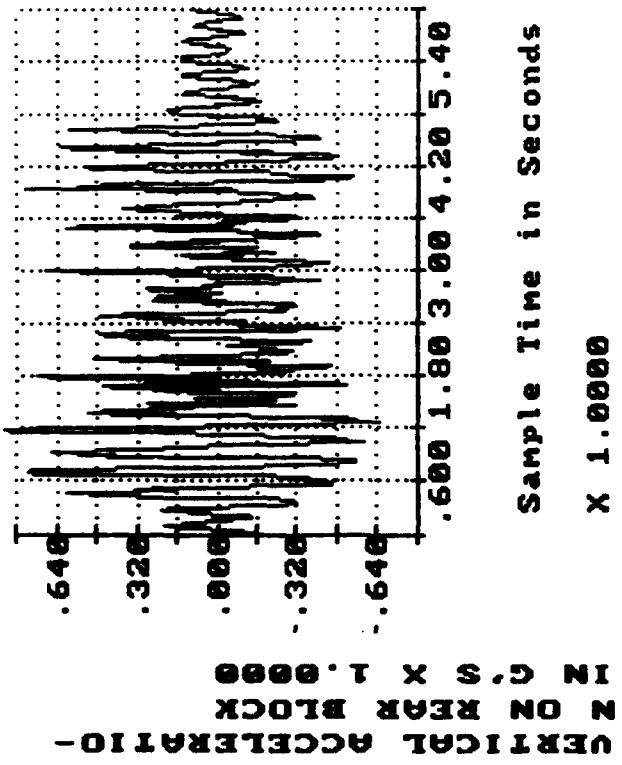
IN G'S X 1.0000



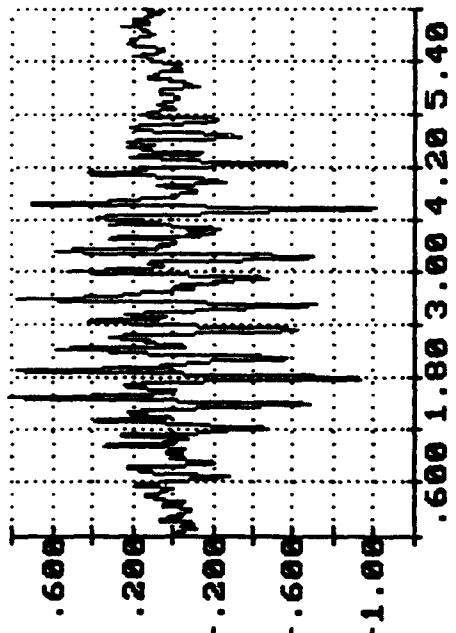
LONGITUDINAL ACCELERATION -  
ON MIDDLE BLOCK

IN G'S X 1.0000

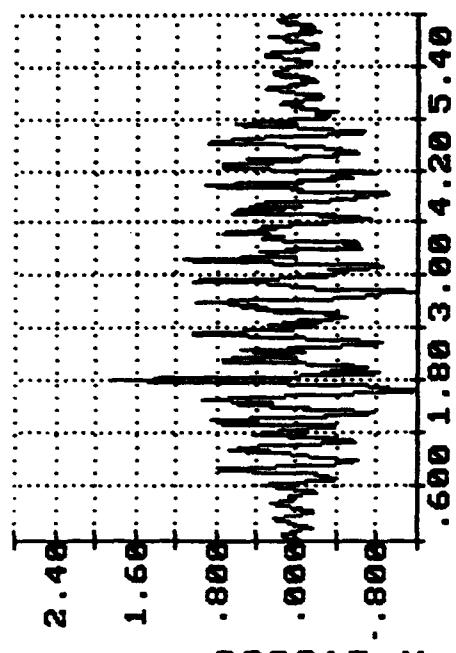
ROAD HAZARD TEST OF ATTACHS ON FLATRACK  
DATE: 14 JULY 1989  
PASS 3, COURSE A



ROAD HAZARD TEST OF ATTACHS ON FLATTRACK  
DATE: 14 JULY 1989  
PASS 3, COURSE B

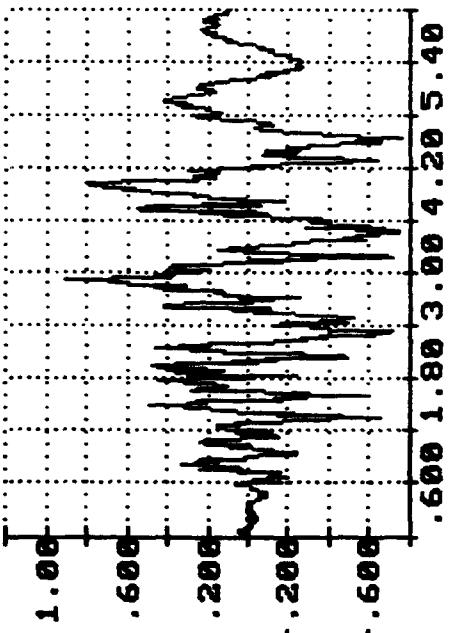


LATERAL ACCELERATION  
ON FORWARD BLOCK  
IN G'S X 1.0000



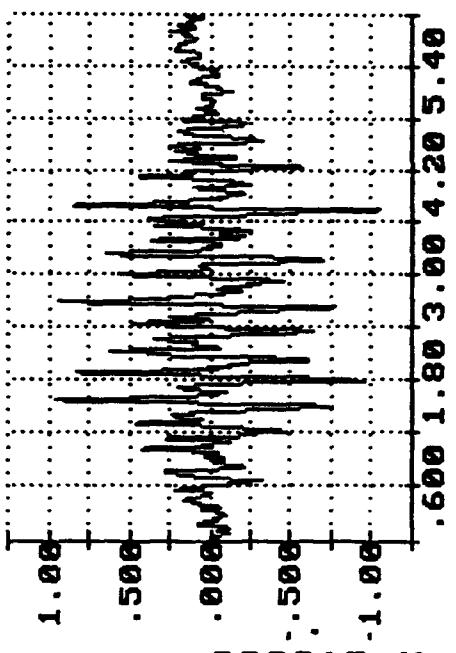
VERTICAL ACCELERATION  
ON FORWARD BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000



IN G'S X 1.0000

LONGITUDINAL ACCELERATION  
ON MIDDLE BLOCK  
IN G'S X 1.0000



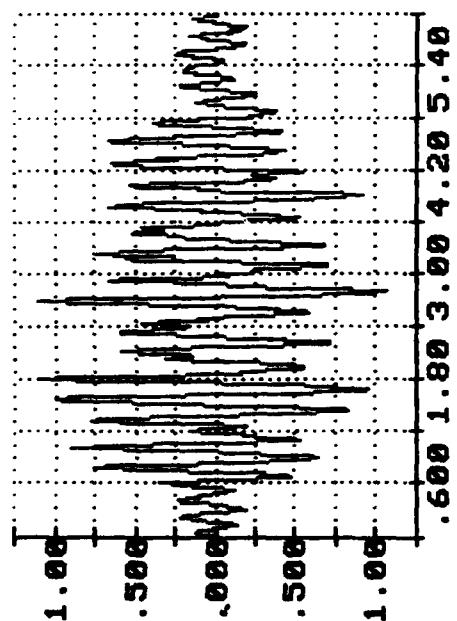
Sample Time in Seconds  
X 1.0000

LATERAL ACCELERATION  
ON FORWARD BLOCK  
IN G'S X 1.0000

IN G'S X 1.0000

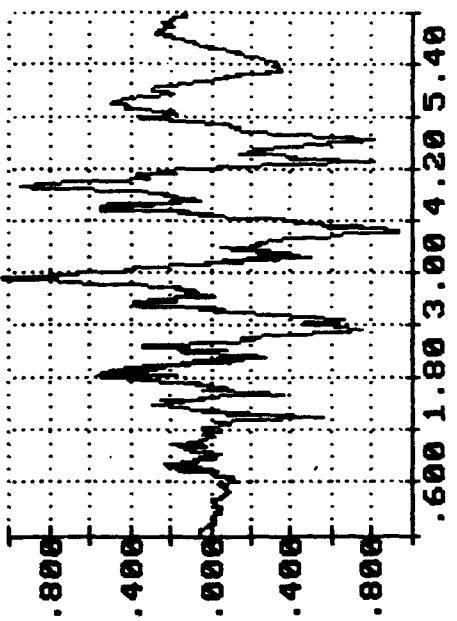
LONGITUDINAL ACCELERATION  
ON MIDDLE BLOCK  
IN G'S X 1.0000

ROAD HAZARD TEST OF ATACMS ON FLAIKACK  
DATE: 14 JULY 1989  
PASS 3, COURSE B



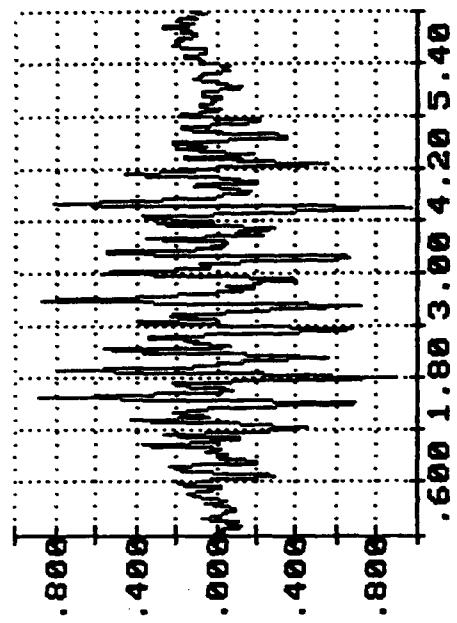
LATERAL ACCELERATION  
ON MIDDLE BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000



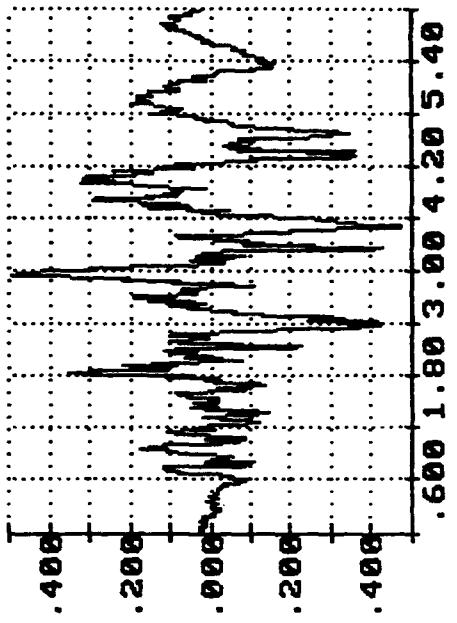
LATERAL ACCELERATION  
ON REAR BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000



LONGITUDINAL ACCELERATION  
ON MIDDLE BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000



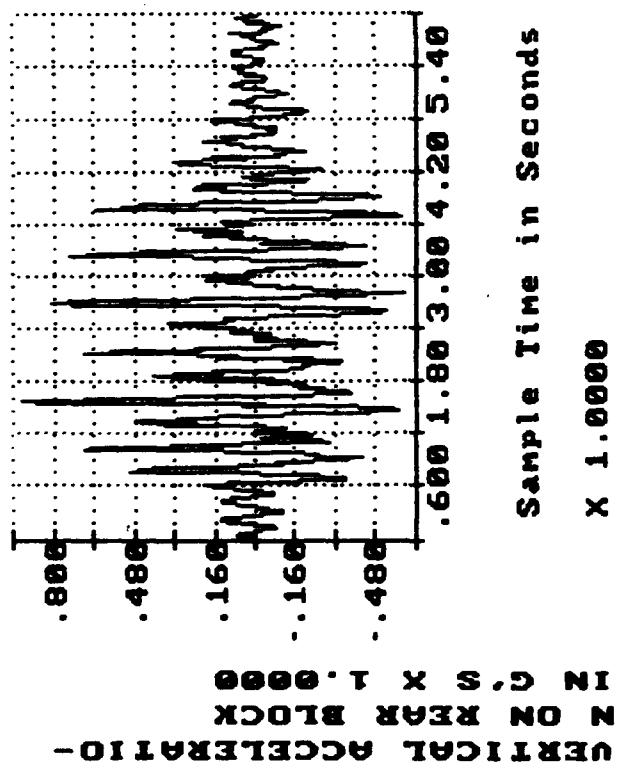
LONGITUDINAL ACCELERATION  
ON REAR BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000

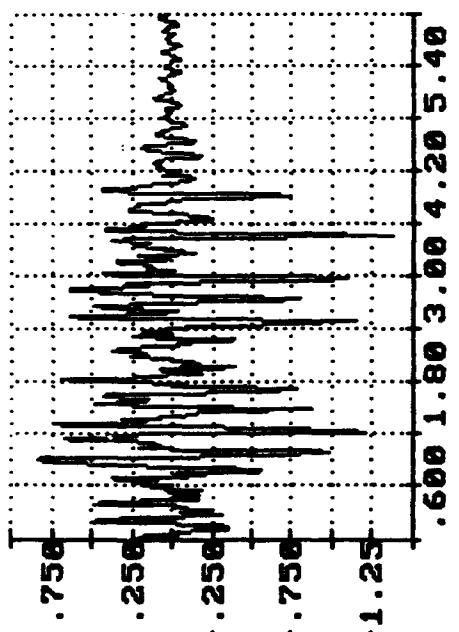


LATERAL ACCELERATION  
ON REAR BLOCK  
IN G'S X 1.0000

ROAD HAZARD TEST OF ATACMS ON FLATRACK  
DATE: 14 JULY 1989  
PASS 3, COURSE B

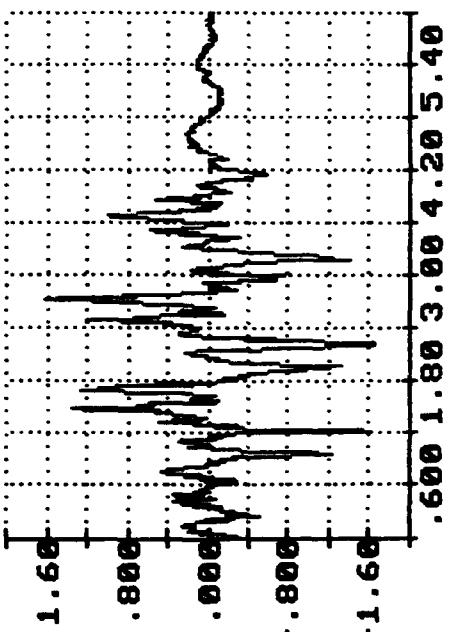


ROAD HAZARD TEST OF ATACMS ON FLATRACK  
 DATE: 14 JULY 1989  
 PASS 4, COURSE A



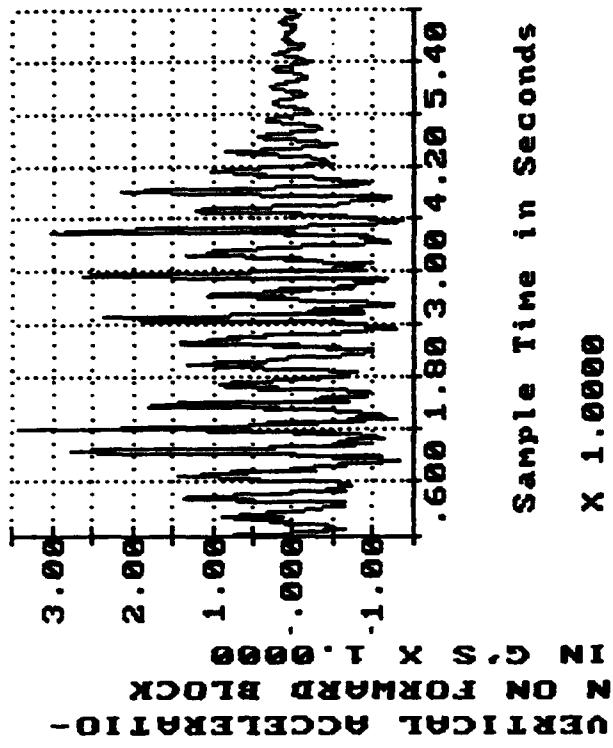
LATERAL ACCELERATION  
 ON FORWARD BLOCK  
 IN G.S X 1.0000

Sample Time in Seconds  
 $\times 1.0000$



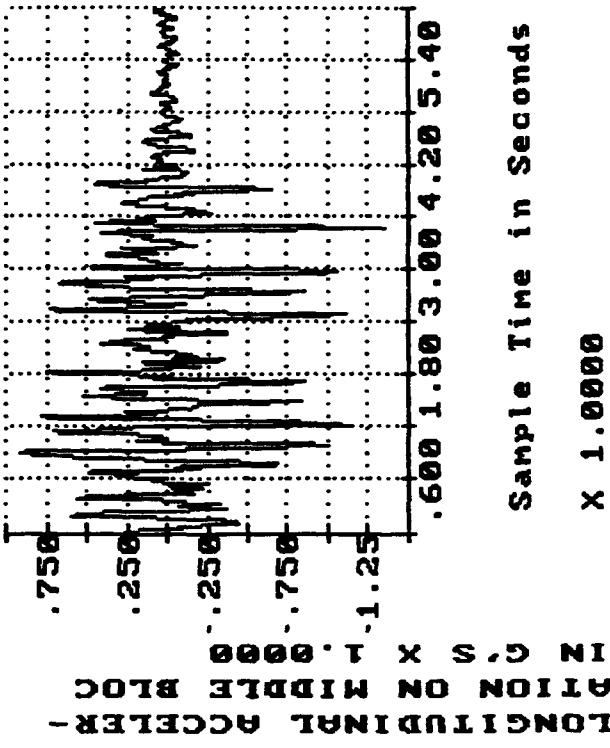
LATERAL ACCELERATION  
 ON FORWARD BLOCK  
 IN G.S X 1.0000

Sample Time in Seconds  
 $\times 1.0000$



VERTICAL ACCELERATION  
 IN ON FORWARD BLOCK  
 IN G.S X 1.0000

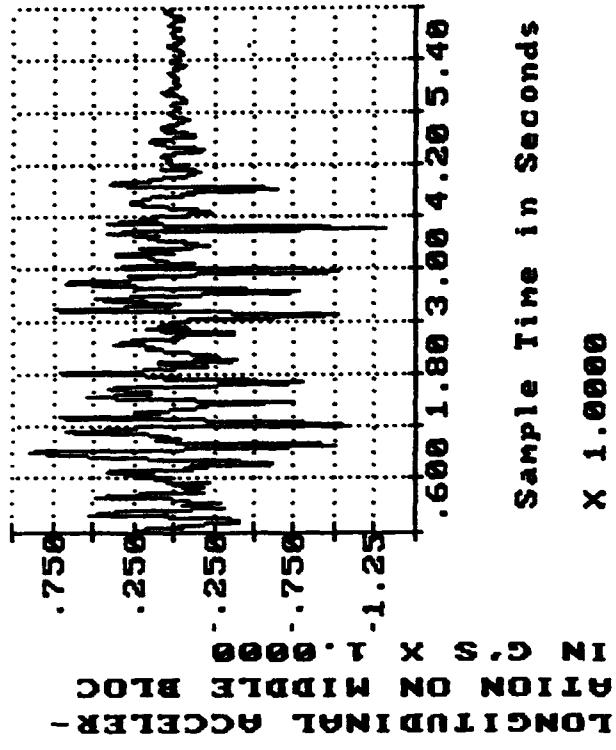
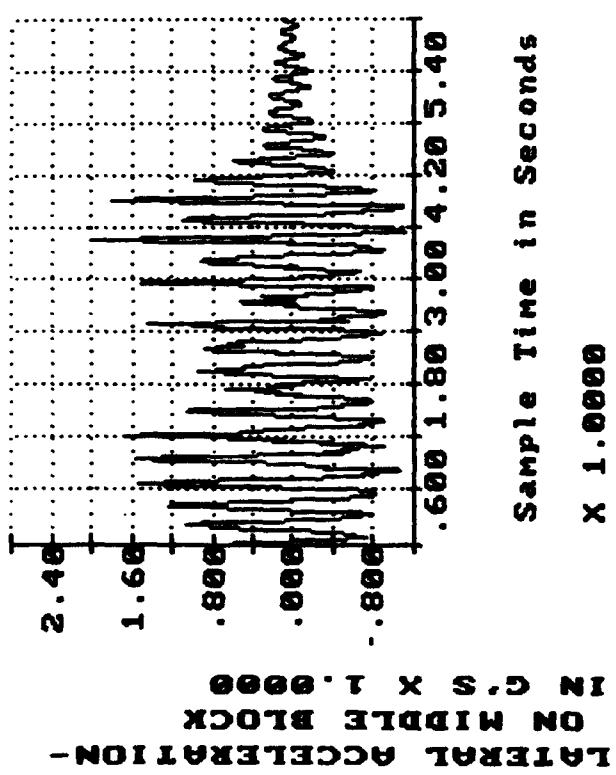
Sample Time in Seconds  
 $\times 1.0000$



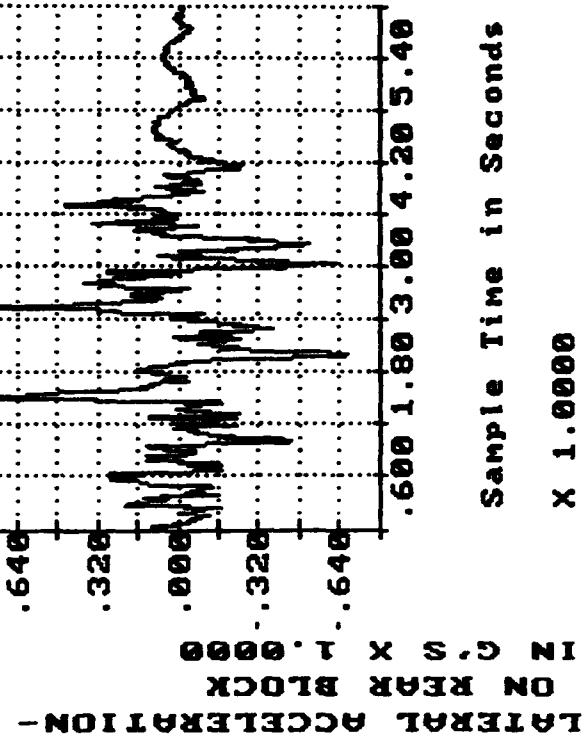
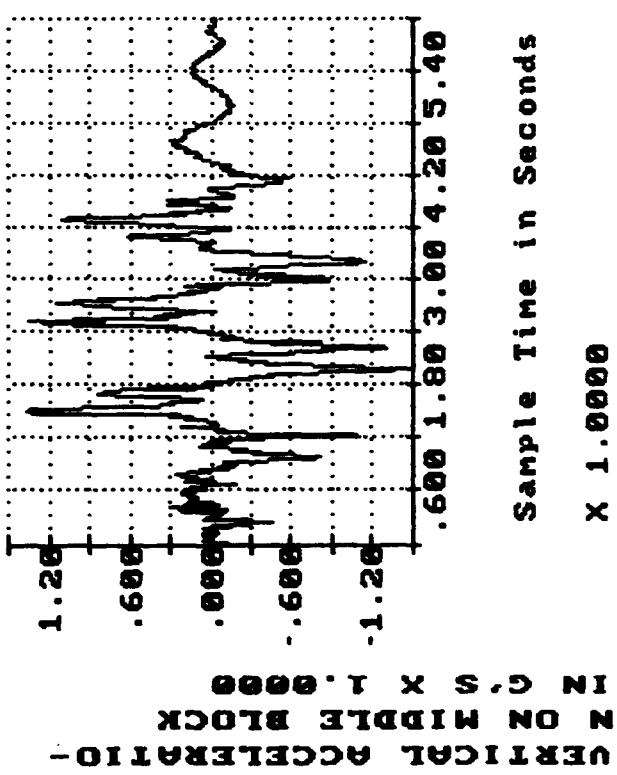
LONGITUDINAL ACCELERATION  
 ON MIDDLE BLOCK  
 IN G.S X 1.0000

Sample Time in Seconds  
 $\times 1.0000$

ROAD HAZARD TEST OF ATTACMS ON FLATRACK  
DATE: 14 JULY 1989  
PASS 4, COURSE A

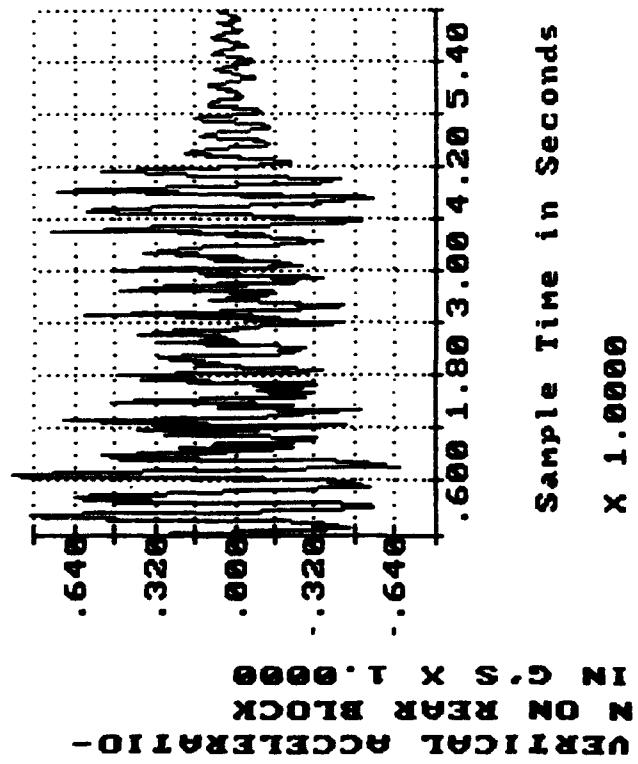


Sample Time in Seconds  
 $\times 1.0000$

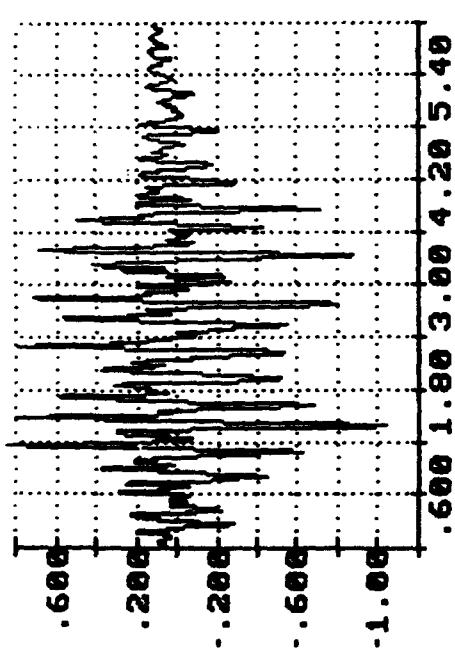


Sample Time in Seconds  
 $\times 1.0000$

ROUND HAZARD TEST FOR ATTACHES ON FLATPACK  
DATE: 14 JULY 1989  
PASS 4, COURSE A

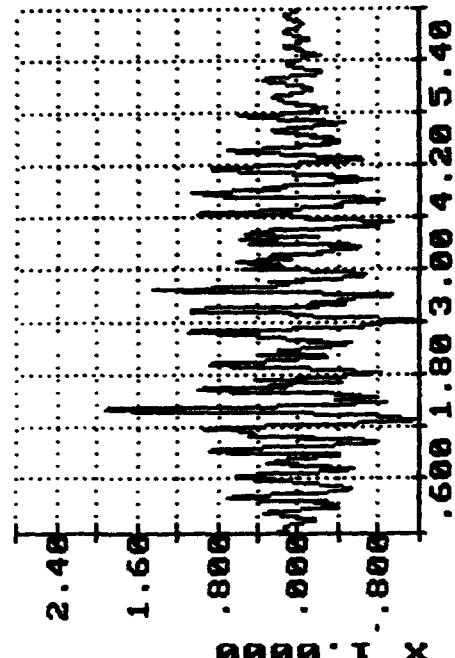


RUHU HAZARD TEST OF AIRCRAFTS ON FLATTRACK  
DATE: 14 JULY 1989  
PASS 4, COURSE B



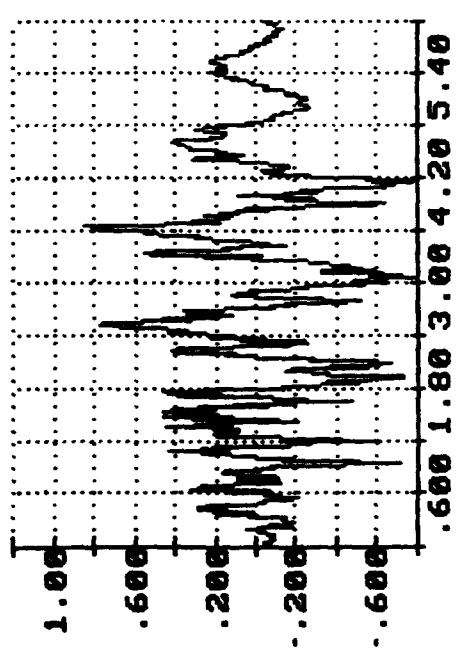
LATERAL ACCELERATION -  
ON FORWARD BLOCK  
ATION ON FORWARD BLOCK  
IN G.S X 1.0000

Sample Time in Seconds  
X 1.0000



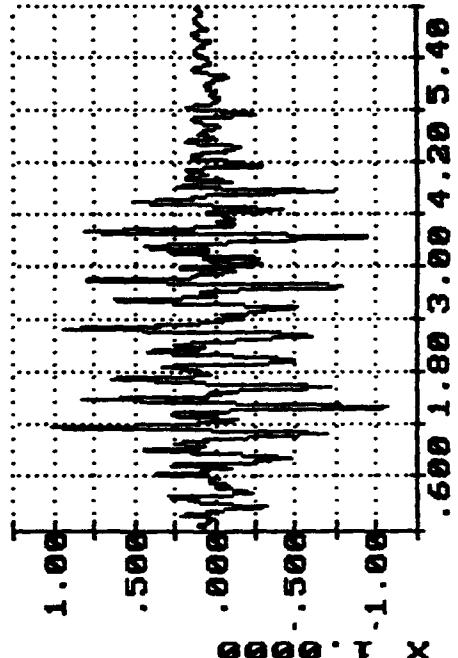
VERTICAL ACCELERATION -  
N ON FORWARD BLOCK  
IN G.S X 1.0000

Sample Time in Seconds  
X 1.0000



LATERAL ACCELERATION -  
ON FORWARD BLOCK  
ATION ON FORWARD BLOCK  
IN G.S X 1.0000

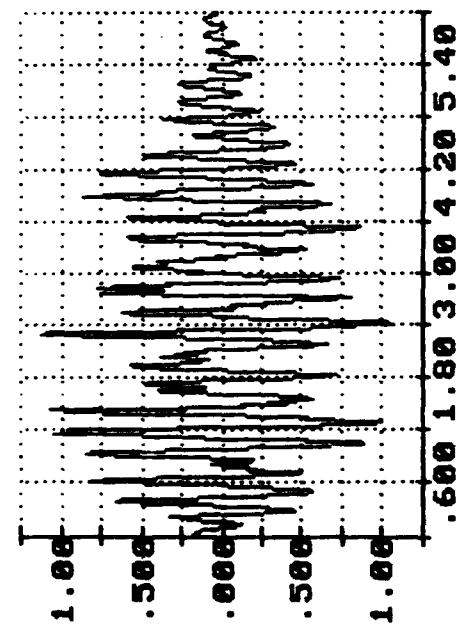
Sample Time in Seconds  
X 1.0000



VERTICAL ACCELERATION -  
N ON MIDDLE BLOCK  
IN G.S X 1.0000

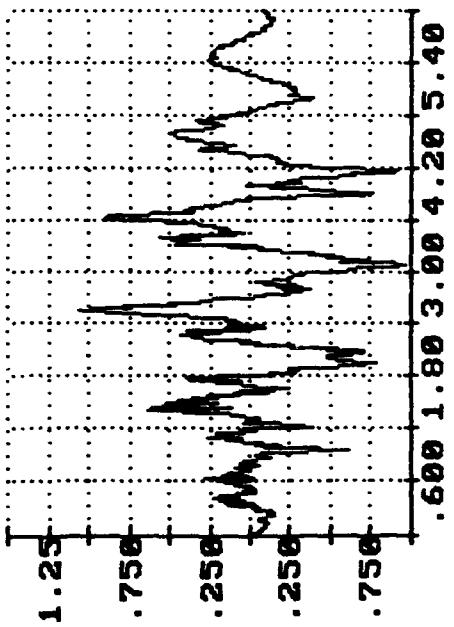
Sample Time in Seconds  
X 1.0000

ROAD HAZARD TESTS OF WHEELS ON FLATBED  
DATE: 14 JULY 1989  
PASS 4, COURSE B



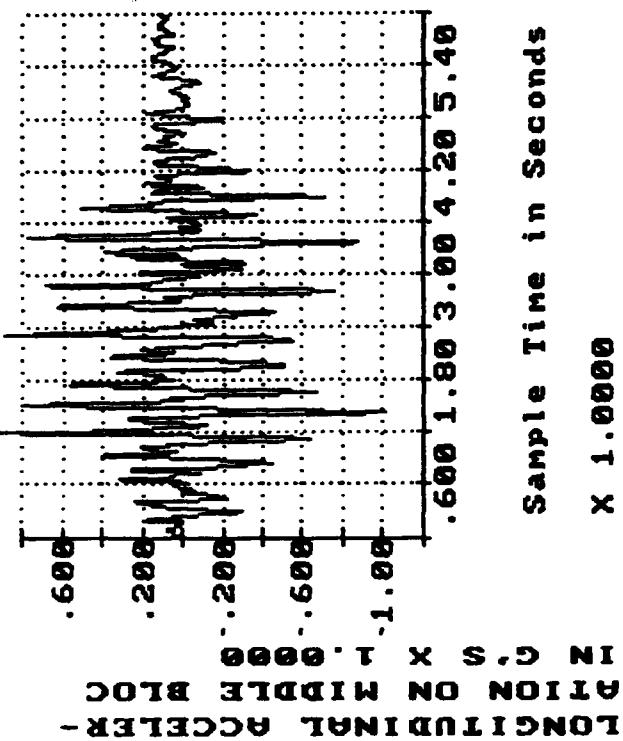
LATERAL ACCELERATION  
ON MIDDLE BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000



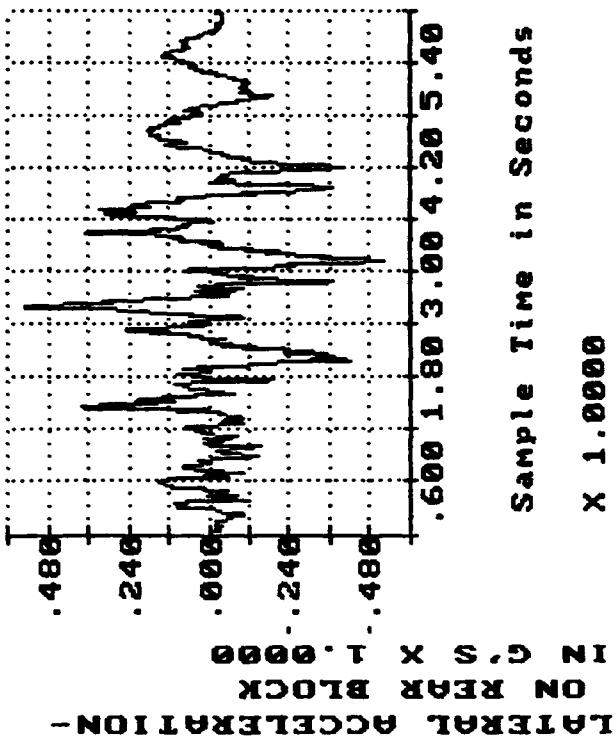
VERTICAL ACCELERATION  
ON MIDDLE BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000



LONGITUDINAL ACCELERATION  
ON MIDDLE BLOCK  
IN G'S X 1.0000

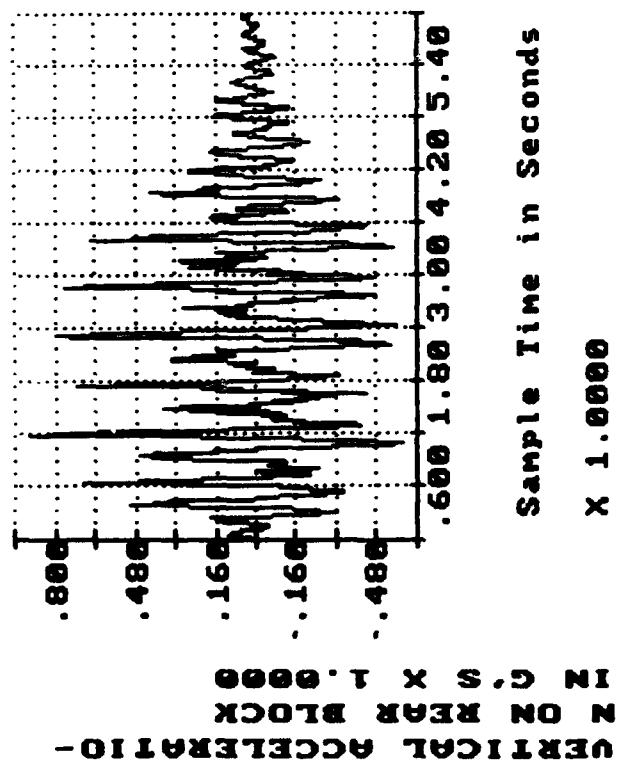
Sample Time in Seconds  
X 1.0000



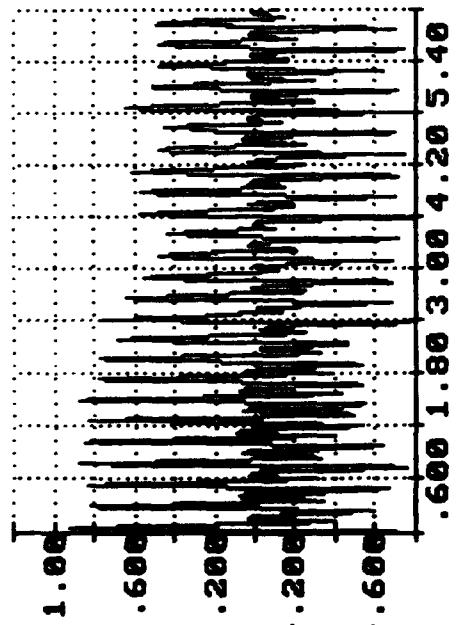
LATERAL ACCELERATION  
ON REAR BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000

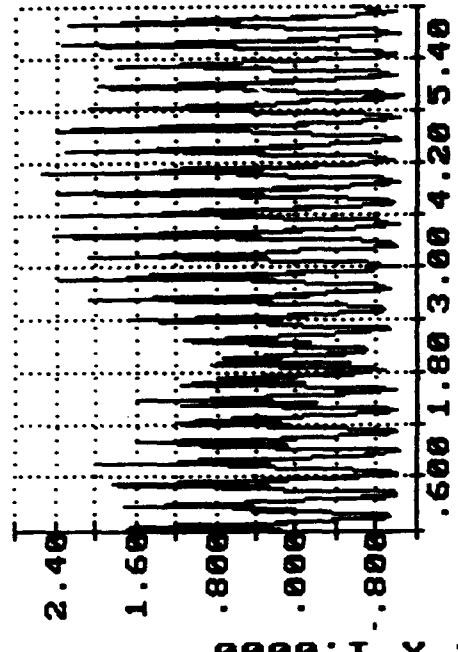
ROAD HAZARD TEST OF ATTACHS ON FLATRACK  
DATE: 14 JULY 1989  
PASS 4, COURSE B



KUAD HAZAKU TEST OF ATTACMS ON FLATTRACK  
DATE: 14 JULY 1989  
WASHBOARD COURSE

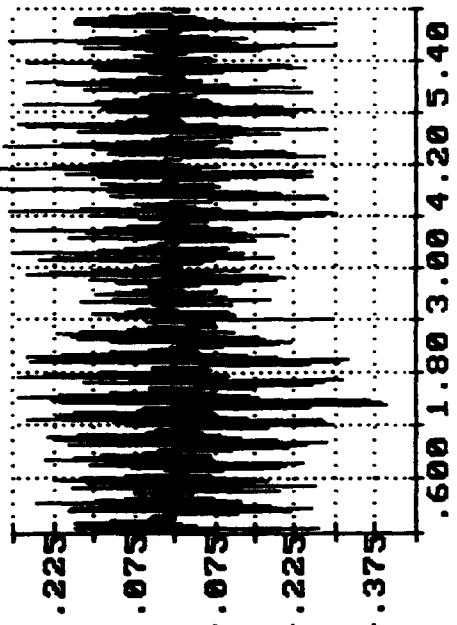


LATERAL ACCELERATION  
ON FORWARD BLOCK  
ATTION ON FORWARD BLOCK  
IN G'S X 1.0000

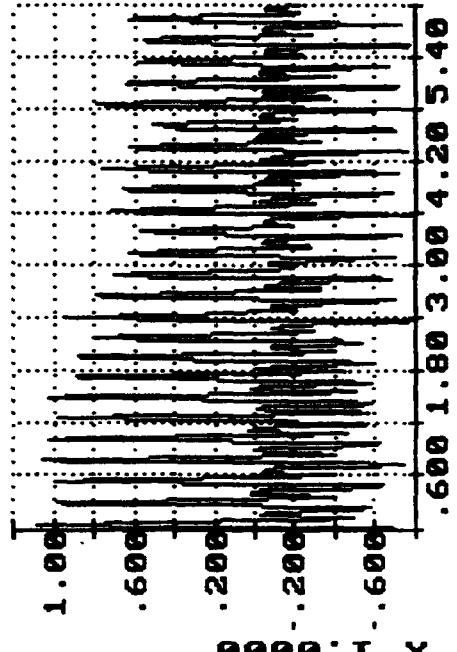


LONGITUDINAL ACCELERATION  
ATTION ON MIDDLE BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000



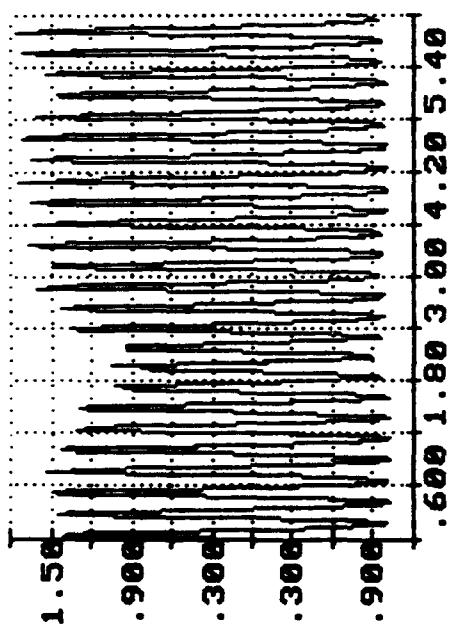
LATERAL ACCELERATION  
ON FORWARD BLOCK  
ATTION ON FORWARD BLOCK  
IN G'S X 1.0000



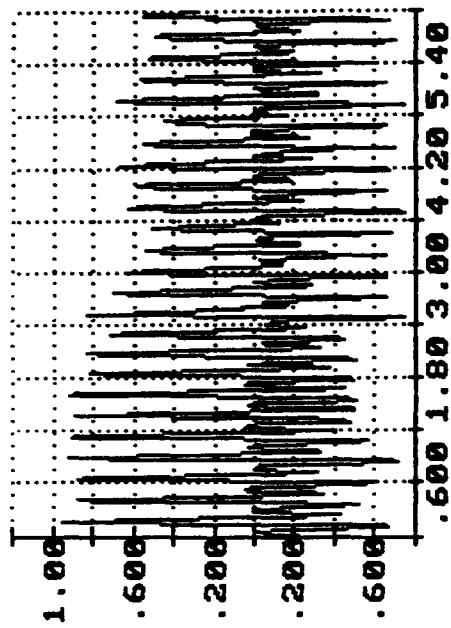
LONGITUDINAL ACCELERATION  
ATTION ON MIDDLE BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000

RUN HAZARD TEST OF HITCHMS ON FLATRACK  
DATE: 14 JULY 1989  
WASHBOARD COURSE

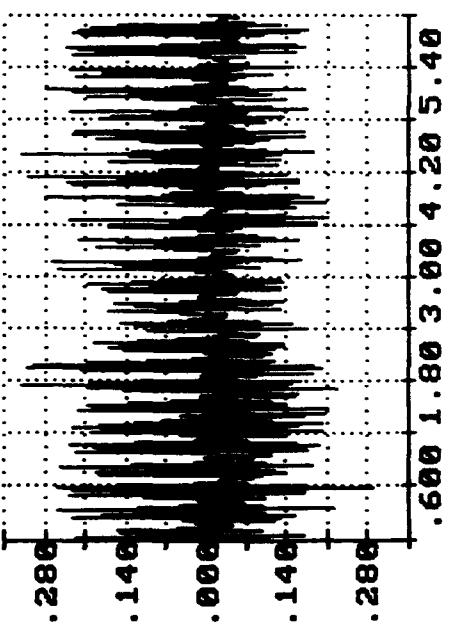


LATERAL ACCELERATION-  
ON MIDDLE BLOCK  
IN G'S X 1.0000

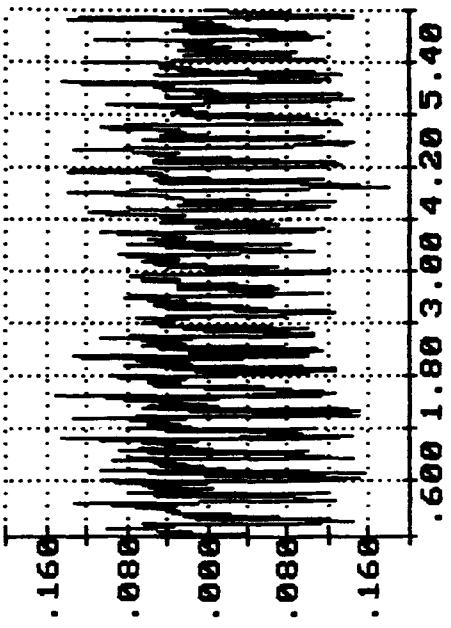


LONGITUDINAL ACCELERATION-  
ON MIDDLE BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000



VERTICAL ACCELERATION-  
ON REAR BLOCK  
IN G'S X 1.0000

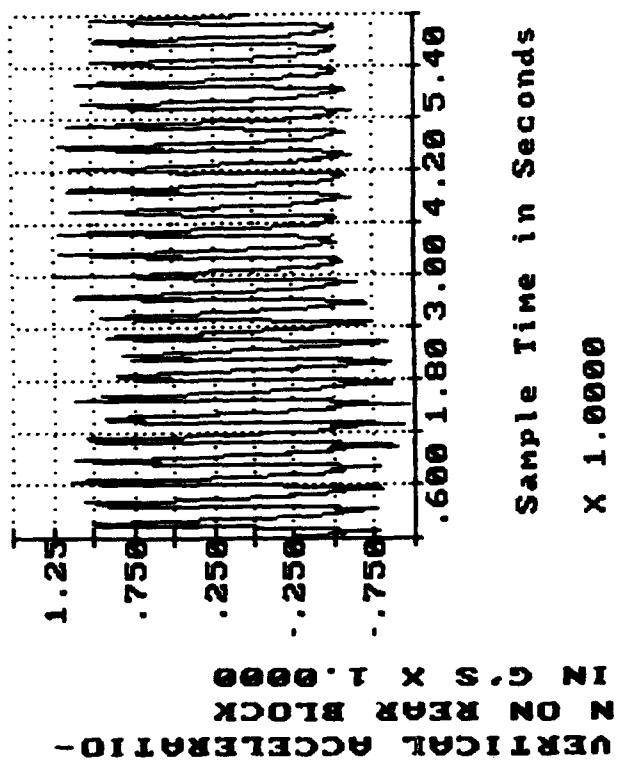


LATERAL ACCELERATION-  
ON REAR BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000

Sample Time in Seconds  
X 1.0000

ROAD HAZARD TEST OF ATACMS ON FLATTRACK  
DATE: 14 JULY 1989  
WASHBOARD COURSE



IN ON REAR BLOCK  
UERTICAL ACCELERATION

## ROAD TEST DATA

TEST NO: 10

DATE: 20 JULY 1989

TEST SPECIMEN: ATACMS on M871 Semitrailer

PASS 1-A OVER FIRST SERIES OF TIES: 0.10 MIN 5.68 MPH

PASS 1-B OVER SECOND SERIES OF TIES: 0.10 MIN 5.68 MPH

REMARKS: No damage.

PASS 2-A OVER FIRST SERIES OF TIES: 0.10 MIN 5.68 MPH

PASS 2-B OVER SECOND SERIES OF TIES: 0.10 MIN 5.68 MPH

REMARKS: No damage.

30 MILE ROAD TEST: No shifting or damage to load.

PANIC STOP TEST: Not performed.

PASS 3-A OVER FIRST SERIES OF TIES: 0.10 MIN 5.68 MPH

PASS 3-B OVER SECOND SERIES OF TIES: 0.10 MIN 5.68 MPH

REMARKS: No damage.

PASS 4-A OVER FIRST SERIES OF TIES: 0.10 MIN 5.68 MPH

PASS 4-B OVER SECOND SERIES OF TIES: 0.10 MIN 5.68 MPH

REMARKS: No damage.

WASHBOARD COURSE: Two passes, load intact without damage.

RESULTS FROM ROAD HAZARD TESTING OF  
 ATACMS IN M871 TRAILER  
 DATE: 20 JULY 1989

TAPE CHANNEL 1 : LONGITUDINAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	-.60	47.79	.0171
PASS 1, COURSE B	8.00	-.63	73.79	.0265
PASS 2, COURSE A	8.00	-.61	50.92	.0184
PASS 2, COURSE B	8.00	-.63	68.18	.0257
PASS 3, COURSE A	8.00	-.53	46.77	.0147
PASS 3, COURSE B	8.00	-.64	71.07	.0271
PASS 4, COURSE A	8.00	.51	53.34	.0165
PASS 4, COURSE B	8.00	-.62	63.10	.0240
WASHBOARD COURSE	8.00	-1.03	63.78	.0426

TAPE CHANNEL 2 : LATERAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	-.78	104.95	.0455
PASS 1, COURSE B	8.00	-.46	81.04	.0240
PASS 2, COURSE A	8.00	-.73	86.92	.0419
PASS 2, COURSE B	8.00	-.46	75.46	.0238
PASS 3, COURSE A	8.00	-.82	69.61	.0368
PASS 3, COURSE B	8.00	-.47	56.08	.0169
PASS 4, COURSE A	8.00	-.72	74.44	.0369
PASS 4, COURSE B	8.00	.47	72.65	.0229
WASHBOARD COURSE	8.00	.25	26.36	.0038

TAPE CHANNEL 3 : VERTICAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	1.55	69.60	.0810
PASS 1, COURSE B	8.00	1.20	191.08	.0227
PASS 2, COURSE A	8.00	1.52	58.53	.0509
PASS 2, COURSE B	8.00	1.35	81.82	.0749
PASS 3, COURSE A	8.00	1.53	60.26	.0659
PASS 3, COURSE B	8.00	1.25	75.96	.0668
PASS 4, COURSE A	8.00	1.49	47.35	.0460
PASS 4, COURSE B	8.00	1.29	96.85	.0799
WASHBOARD COURSE	8.00	2.27	43.19	.0625

TAPE CHANNEL 4 : LONGITUDINAL ACCELERATION ON MIDDLE BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	.66	79.75	.0351
PASS 1, COURSE B	8.00	-.69	72.41	.0287
PASS 2, COURSE A	8.00	.69	148.27	.0229
PASS 2, COURSE B	8.00	-.70	67.47	.0276
PASS 3, COURSE A	8.00	.67	78.06	.0341
PASS 3, COURSE B	8.00	-.69	67.75	.0299
PASS 4, COURSE A	8.00	.63	55.69	.0223
PASS 4, COURSE B	8.00	-.68	65.05	.0269
WASHBOARD COURSE	8.00	-1.13	61.57	.0461

TAPE CHANNEL 5 : LATERAL ACCELERATION ON MIDDLE BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	1.72	179.54	.0632
PASS 1, COURSE B	8.00	1.36	142.29	.0657
PASS 2, COURSE A	8.00	1.34	99.31	.0869
PASS 2, COURSE B	8.00	1.21	105.02	.0719
PASS 3, COURSE A	8.00	1.78	269.65	.0031
PASS 3, COURSE B	8.00	1.42	103.44	.0882
PASS 4, COURSE A	8.00	1.65	414.93	.0073
PASS 4, COURSE B	8.00	1.46	105.01	.0918
WASHBOARD COURSE	8.00	1.57	86.01	.0852

TAPE CHANNEL 7 : VERTICAL ACCELERATION ON MIDDLE BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	-.91	107.20	.0614
PASS 1, COURSE B	8.00	.59	427.28	.0359
PASS 2, COURSE A	8.00	-.85	105.28	.0590
PASS 2, COURSE B	8.00	.56	409.11	.0445
PASS 3, COURSE A	8.00	.86	125.95	.0707
PASS 3, COURSE B	8.00	.59	116.11	.0480
PASS 4, COURSE A	8.00	.85	147.11	.0842
PASS 4, COURSE B	8.00	.66	113.88	.0496
WASHBOARD COURSE	8.00	.22	32.98	.0041

## TAPE CHANNEL 8 : LONGITUDINAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	.62	234.44	.0246
PASS 1, COURSE B	8.00	-.63	71.36	.0260
PASS 2, COURSE A	8.00	.64	94.58	.0382
PASS 2, COURSE B	8.00	-.64	65.89	.0255
PASS 3, COURSE A	8.00	.63	86.69	.0345
PASS 3, COURSE B	8.00	-.63	85.46	.0295
PASS 4, COURSE A	8.00	.58	163.34	.0310
PASS 4, COURSE B	8.00	-.62	65.74	.0242
WASHBOARD COURSE	8.00	-.1.02	63.00	.0426

## TAPE CHANNEL 9 : LATERAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	-.45	87.45	.0263
PASS 1, COURSE B	8.00	-.41	107.90	.0286
PASS 2, COURSE A	8.00	-.46	96.01	.0309
PASS 2, COURSE B	8.00	-.40	101.08	.0263
PASS 3, COURSE A	8.00	-.52	75.62	.0278
PASS 3, COURSE B	8.00	-.39	109.06	.0283
PASS 4, COURSE A	8.00	-.48	82.21	.0261
PASS 4, COURSE B	8.00	-.41	106.07	.0283
WASHBOARD COURSE	8.00	-.20	60.06	.0069

## TAPE CHANNEL 10 : VERTICAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	1.26	97.07	.0718
PASS 1, COURSE B	8.00	1.02	86.21	.0556
PASS 2, COURSE A	8.00	1.16	73.99	.0571
PASS 2, COURSE B	8.00	1.02	77.77	.0522
PASS 3, COURSE A	8.00	1.25	94.09	.0706
PASS 3, COURSE B	8.00	1.00	91.50	.0551
PASS 4, COURSE A	8.00	1.20	84.65	.0647
PASS 4, COURSE B	8.00	1.02	97.92	.0591
WASHBOARD COURSE	8.00	1.01	75.79	.0485

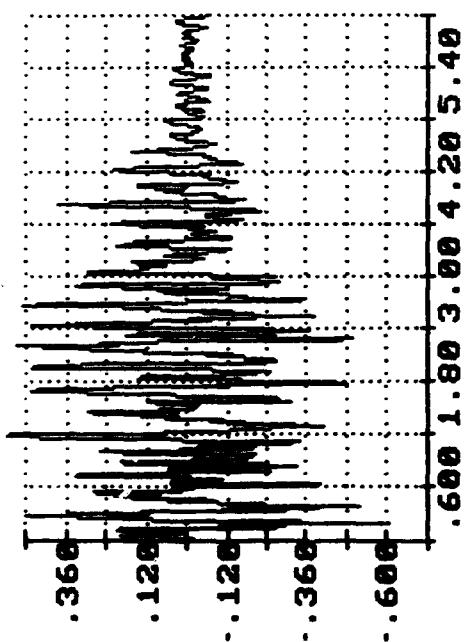
## TAPE CHANNEL 14 : VERTICAL ACCELERATION ON TRAILER BED

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	1.48	36.29	.0364
PASS 1, COURSE B	8.00	-1.38	20.75	.0155
PASS 2, COURSE A	8.00	1.46	42.36	.0438
PASS 2, COURSE B	8.00	-1.92	33.17	.0455
PASS 3, COURSE A	8.00	1.69	48.03	.0564
PASS 3, COURSE B	8.00	1.17	68.26	.0564
PASS 4, COURSE A	8.00	1.56	46.57	.0496
PASS 4, COURSE B	8.00	1.19	77.75	.0585
WASHBOARD COURSE	8.00	1.32	49.11	.0467

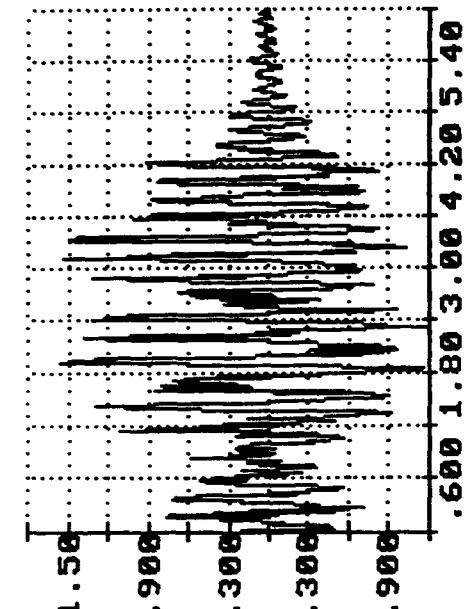
## NOTES:

\*\*\*\*\*: DATA NOT AVAILABLE.

ROAD HAZARD TEST OF ATTACHS ON M871 TRAILER  
DATE: 20 & 21 JULY 1989  
PASS 1. COURSE A

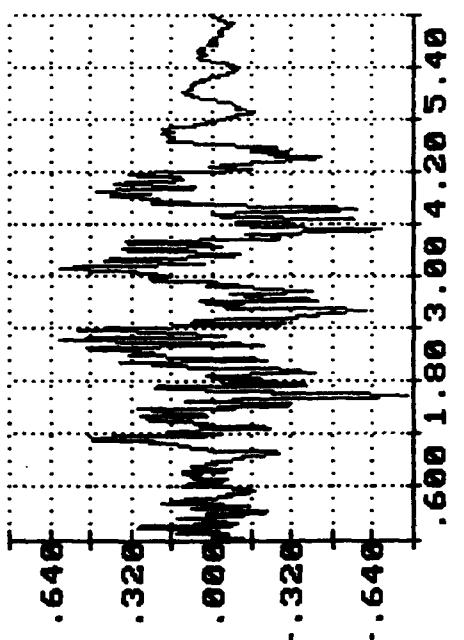


LATERAL ACCELERATION  
ON FORWARD BLOCK  
IN G'S X 1.0000



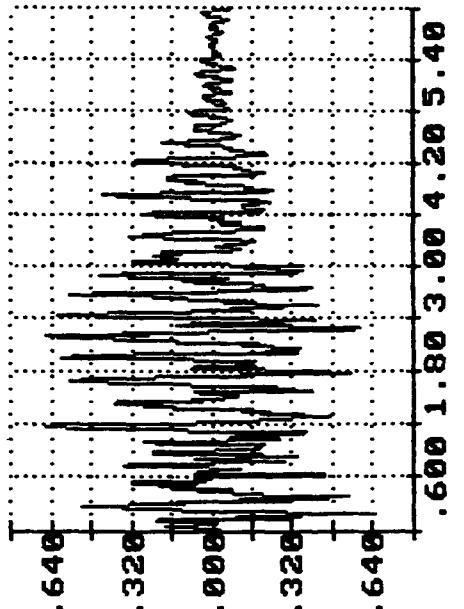
VERTICAL ACCELERATION  
ON FORWARD BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000



LATERAL ACCELERATION  
ON FORWARD BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000

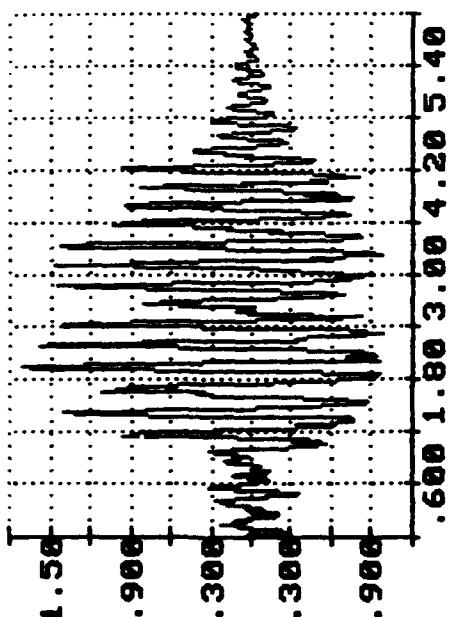


LONGITUDINAL ACCELERATION  
ON MIDDLE BLOCK  
IN G'S X 1.0000

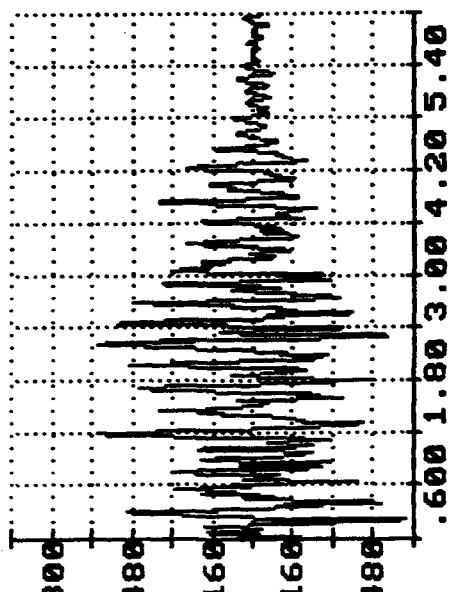
Sample Time in Seconds  
X 1.0000

Sample Time in Seconds  
X 1.0000

ROAD HAZARD TEST OF ATTACHES ON M871 TRAILER  
DATE: 20 & 21 JULY 1989  
PASS 1, COURSE A

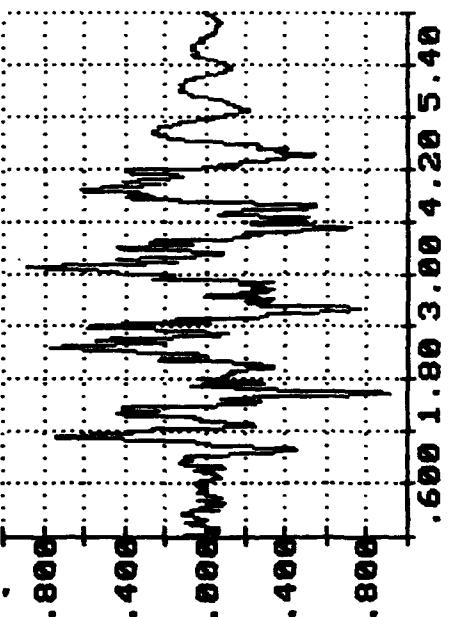


LATERAL ACCELERATION -  
ON MIDDLE BLOCK  
IN G.S X 1.0000



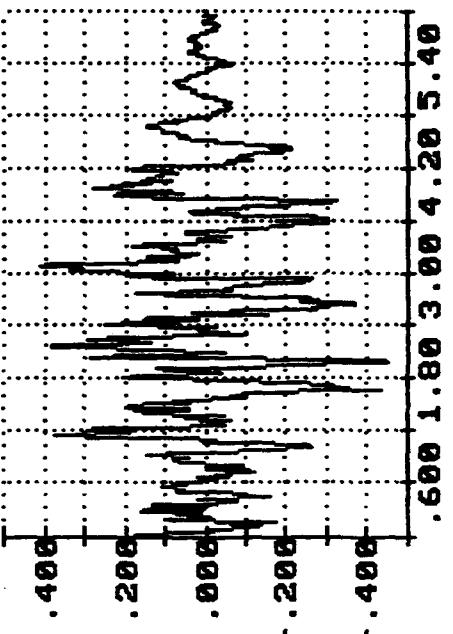
LONGITUDINAL ACCELERATION -  
ON MIDDLE BLOCK  
IN G.S X 1.0000

Sample Time in Seconds  
X 1.0000



VERTICAL ACCELERATION -  
ON MIDDLE BLOCK  
IN G.S X 1.0000

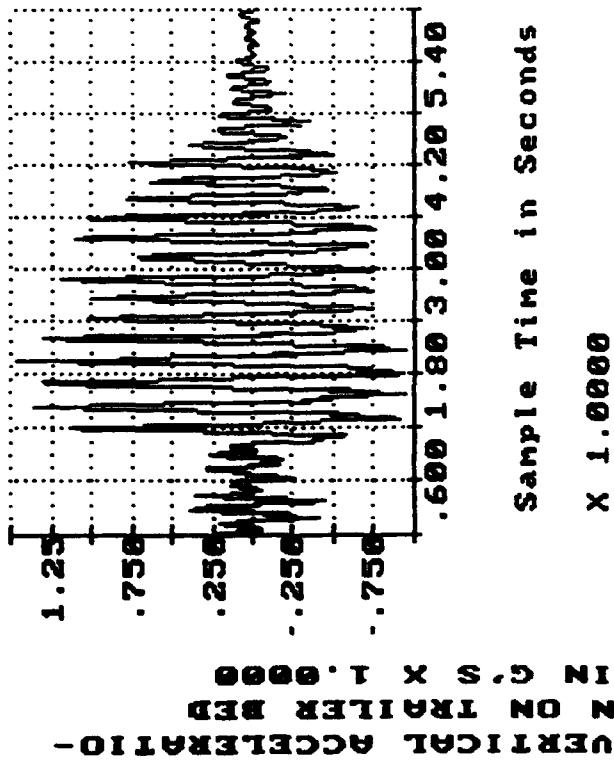
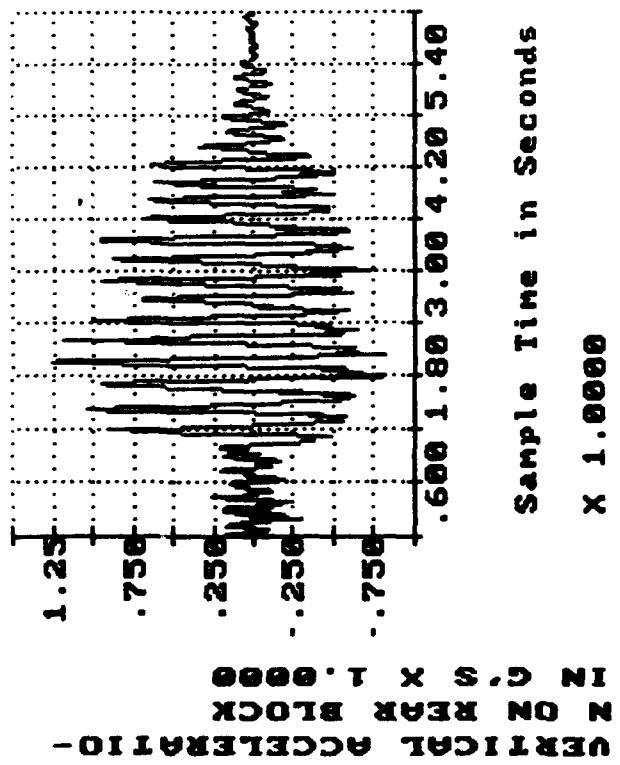
LATERAL ACCELERATION -  
ON REAR BLOCK  
IN G.S X 1.0000



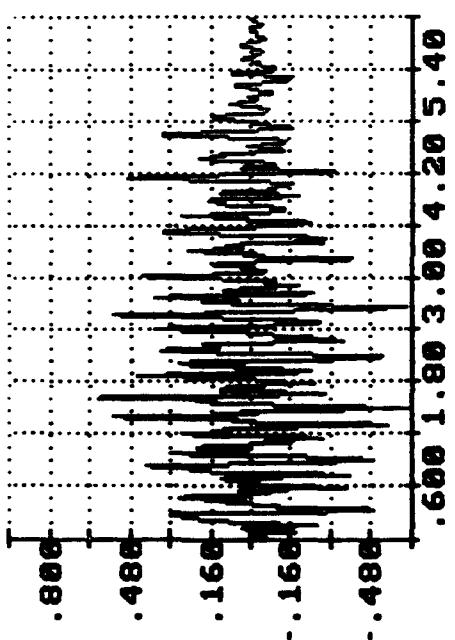
Sample Time in Seconds  
X 1.0000

Sample Time in Seconds  
X 1.0000

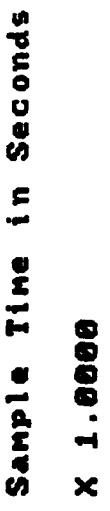
ROAD HAZARD TEST OF ATTACHS ON M871 TRAILER  
DATE: 20 & 21 JULY 1989  
PASS 1, COURSE A



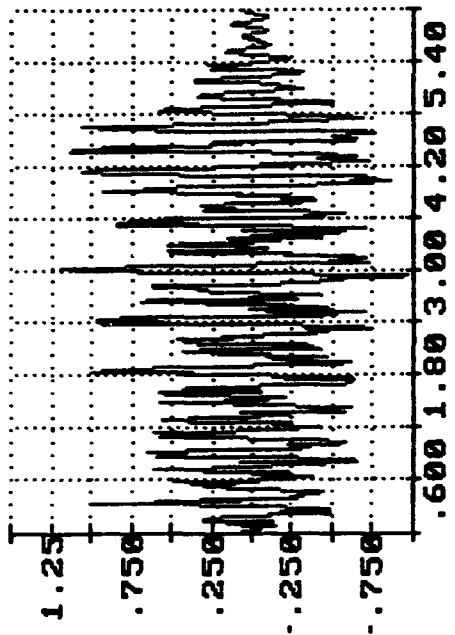
ROAD HAZARD TEST OF ATTACHS ON M671 TRAILER  
DATE: 20 & 21 JULY 1989  
PASS 1, COURSE B



LATERAL ACCELERATION -  
ATTACH ON FORWARD BLOCK  
IN G.S X 1.0000



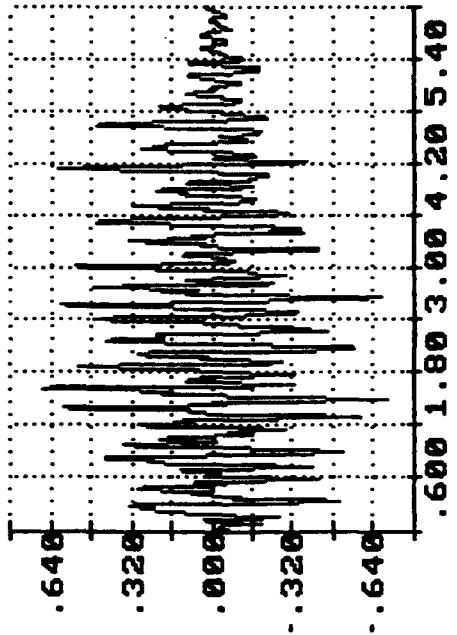
LATERAL ACCELERATION -  
ON FORWARD BLOCK  
IN G.S X 1.0000



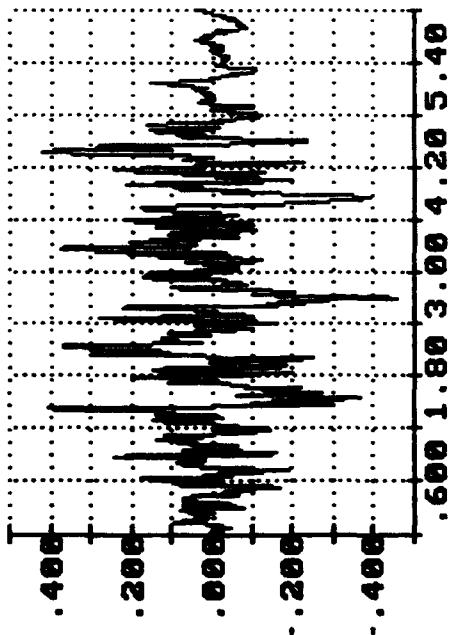
VERTICAL ACCELERATION -  
ATTACH ON FORWARD BLOCK  
IN G.S X 1.0000



VERTICAL ACCELERATION -  
ATTACH ON FORWARD BLOCK  
IN G.S X 1.0000



LONGITUDINAL ACCELERATION -  
ATTACH ON MIDDLE BLOCK  
IN G.S X 1.0000

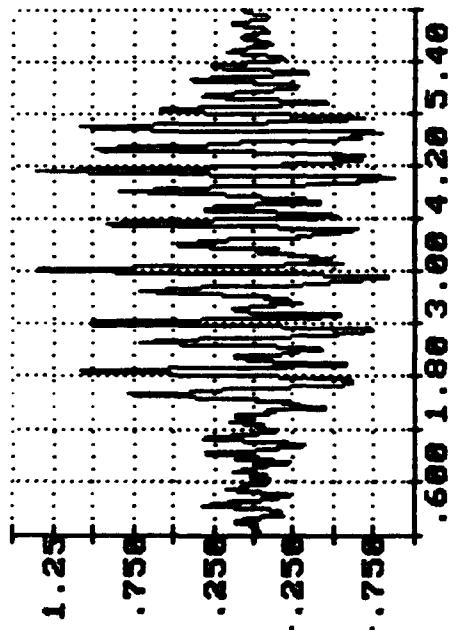


LONGITUDINAL ACCELERATION -  
ON FORWARD BLOCK  
IN G.S X 1.0000



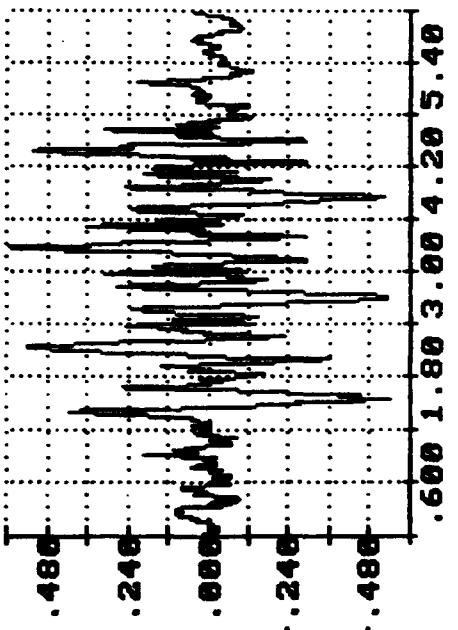
LONGITUDINAL ACCELERATION -  
ATTACH ON MIDDLE BLOCK  
IN G.S X 1.0000

ROAD HAZARD TEST OF ATTACHS ON M871 TRAILER  
DATE: 20 & 21 JULY 1989  
PASS 1, COURSE B



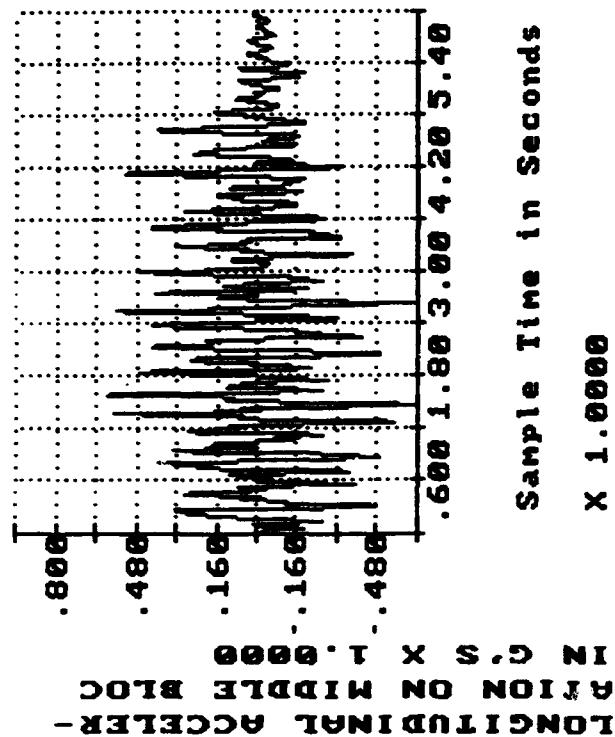
LATERAL ACCELERATION-  
ON MIDDLE BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000



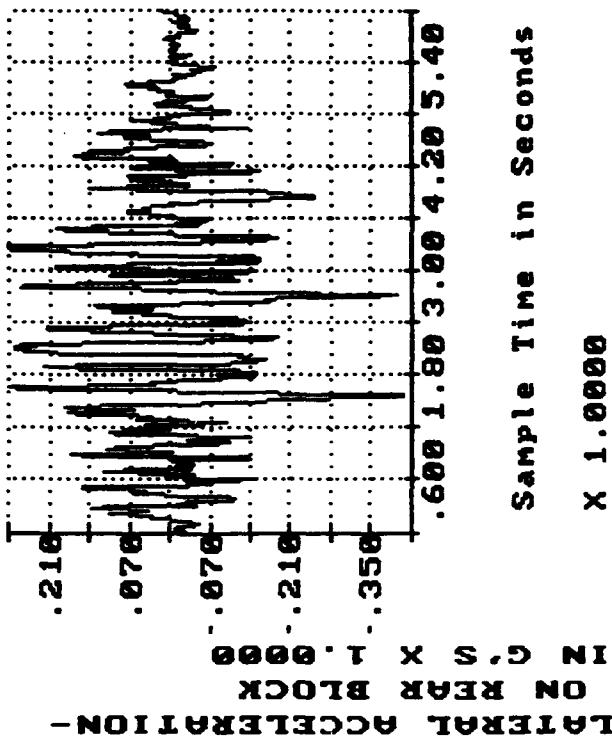
VERTICAL ACCELERATION-  
ON MIDDLE BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000



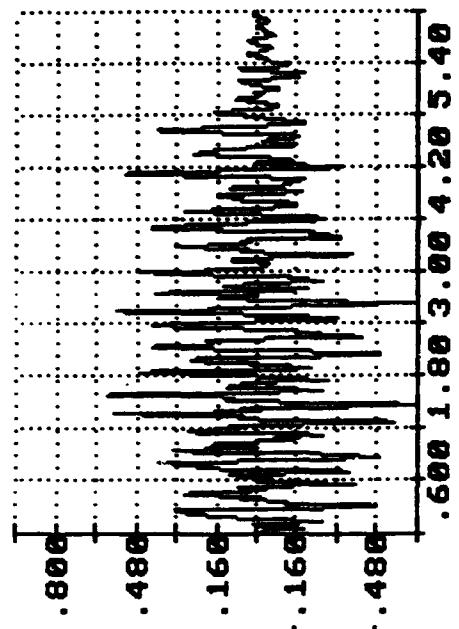
LONGITUDINAL ACCELERATION-  
ATITION ON MIDDLE BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000



LATERAL ACCELERATION-  
ON REAR BLOCK  
IN G'S X 1.0000

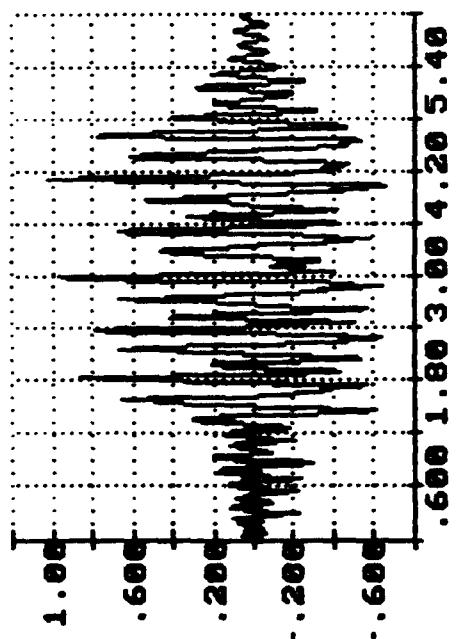
Sample Time in Seconds  
X 1.0000



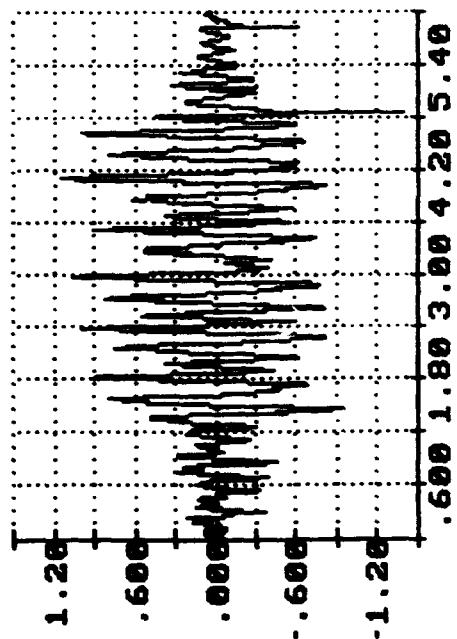
VERTICAL ACCELERATION-  
ON MIDDLE BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000

ROAD HAZARD TEST OF ATTACHS ON M871 TRAILER  
DATE: 20 & 21 JULY 1989  
PASS 1, COURSE B

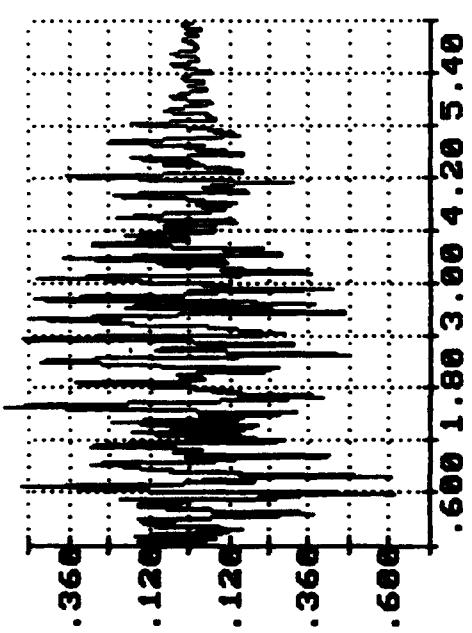


Vertical Acceleration  
IN G'S X 1.0000  
Sample Time in Seconds  
X 1.0000

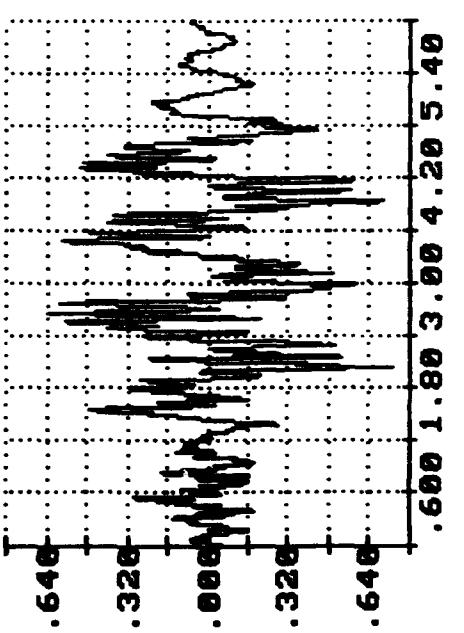


Vertical Acceleration  
IN G'S X 1.0000  
ON TRAILER END  
IN G'S X 1.0000  
Vertical Acceleration  
IN G'S X 1.0000

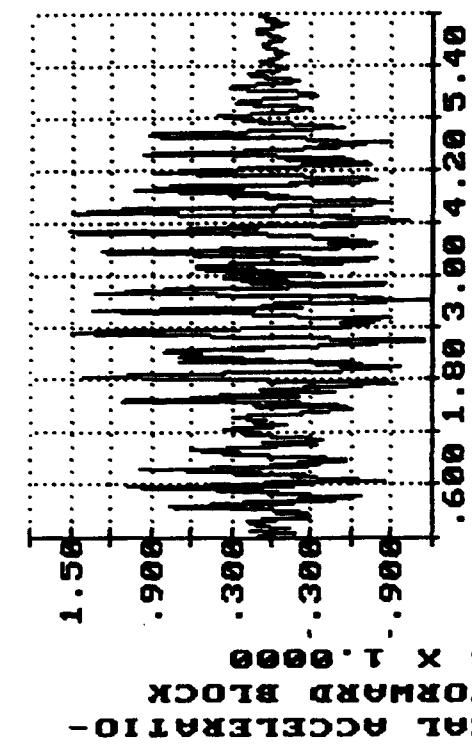
ROAD HAZARD TEST OF ATACMS ON M871 TRAILER  
DATE: 20 & 21 JULY 1989  
PASS 2, COURSE A



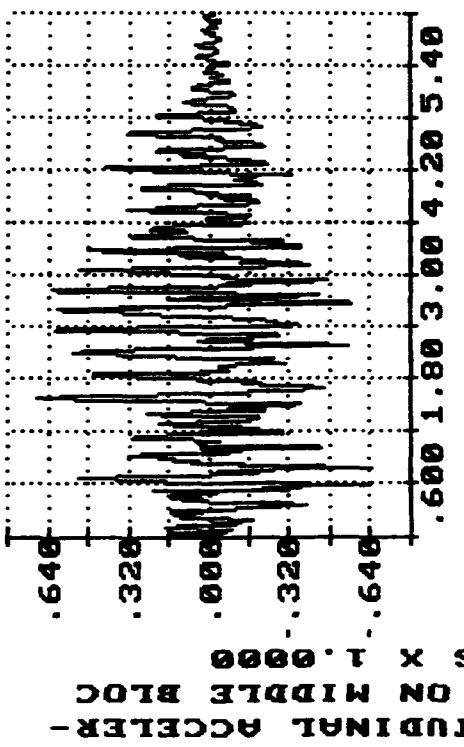
Sample Time in Seconds  
X 1.0000



Sample Time in Seconds  
X 1.0000



Sample Time in Seconds  
X 1.0000

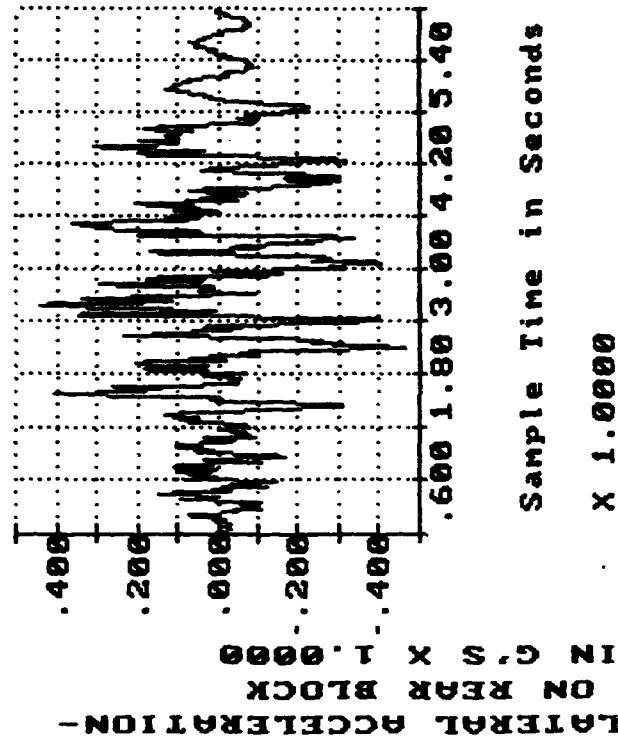
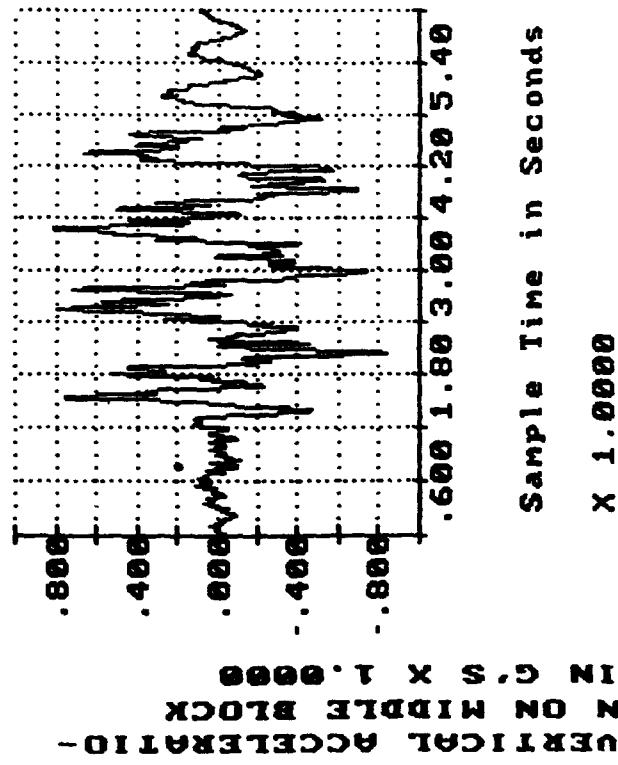
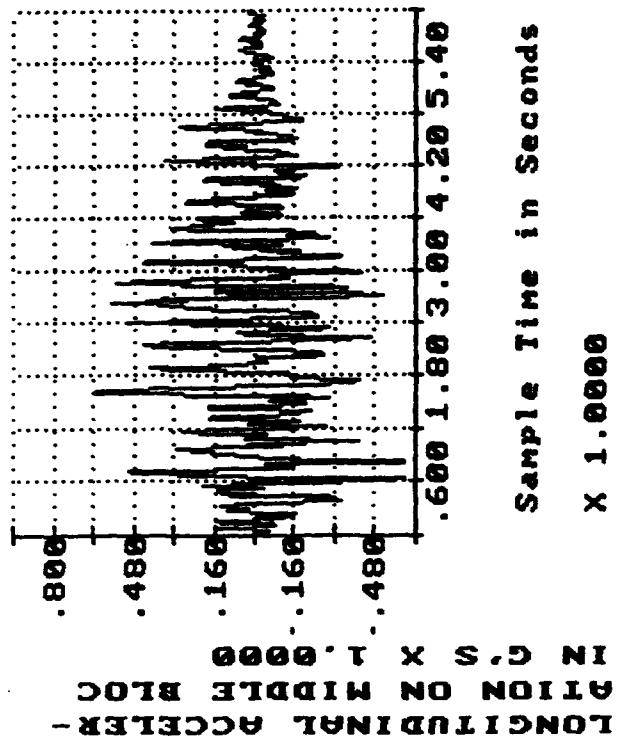
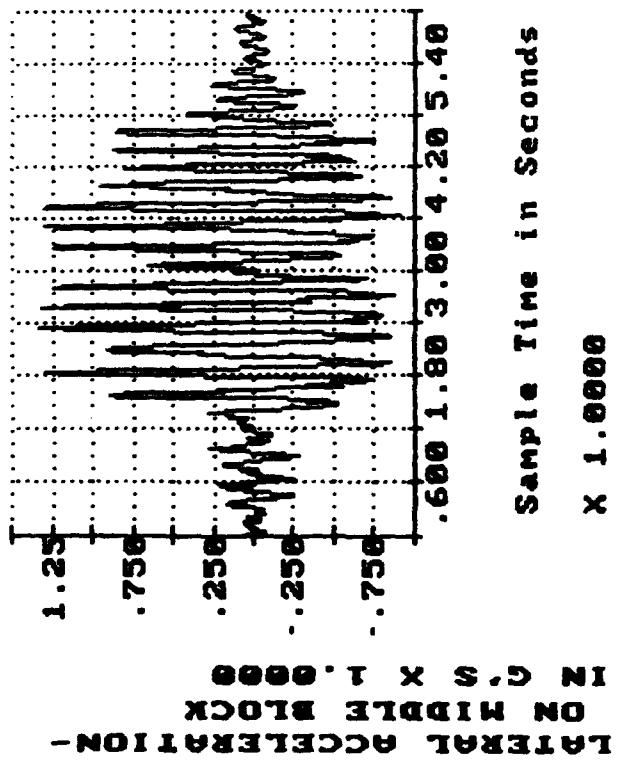


Sample Time in Seconds  
X 1.0000

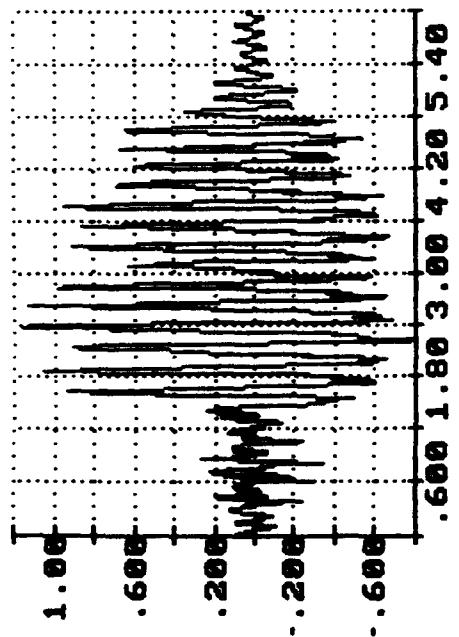
LONGITUDINAL ACCELERATION ON FORWARD BLOCK  
IN G.S X 1.0000

LONGITUDINAL ACCELERATION ON MIDDLE BLOCK  
IN G.S X 1.0000

ROAD HAZARD TEST OF ATACMS ON M871 TRAILER  
DATE: 20 & 21 JULY 1989  
PASS 2, COURSE A

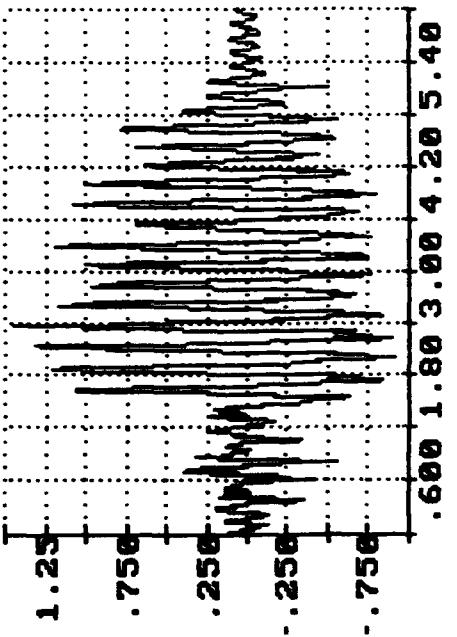


ROAD HAZARD TEST OF ATTACHS ON M871 TRAILER  
DATE: 20 & 21 JULY 1989  
PASS 2, COURSE A



VERTICAL ACCELERATION  
IN ON REAR BLOCK  
IN G'S X 1.0000

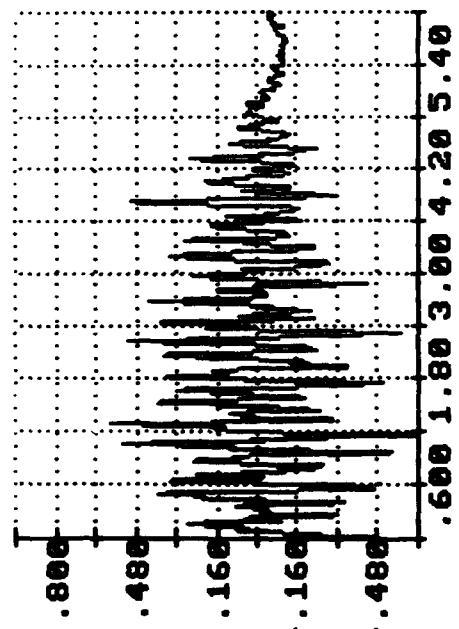
SAMPLE TIME IN SECONDS  
X 1.0000



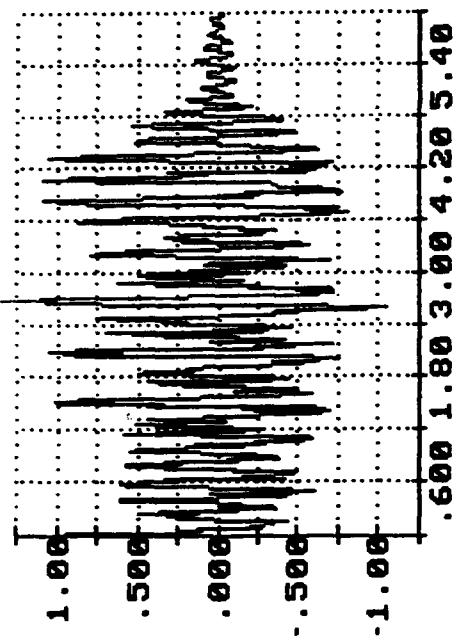
VERTICAL ACCELERATION  
IN ON REAR BLOCK  
IN G'S X 1.0000

SAMPLE TIME IN SECONDS  
X 1.0000

ROAD HAZARD TEST OF ATTACHMENTS ON M871 TRAILER  
DATE: 20 & 21 JULY 1989  
PASS 2, COURSE B



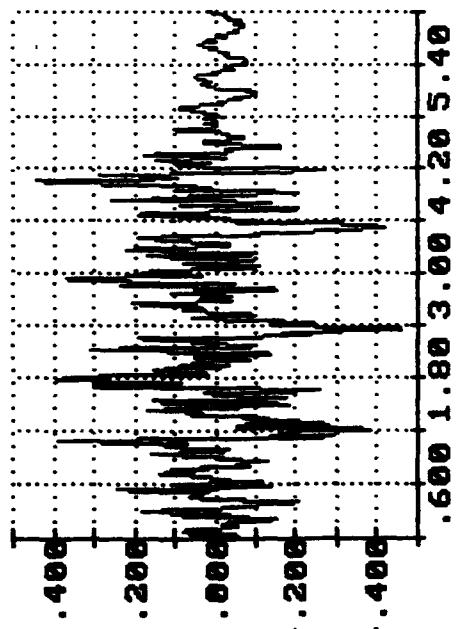
LATERAL ACCELERATION  
IN G'S X 1.0000  
ACTION ON FORWARD BLOCK



VERTICAL ACCELERATION  
IN G'S X 1.0000  
ACTION ON FORWARD BLOCK

Sample Time in Seconds

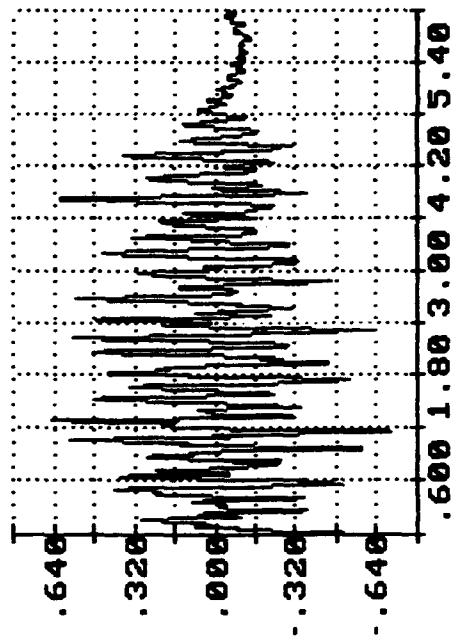
X 1.0000



LATERAL ACCELERATION  
IN G'S X 1.0000  
ACTION ON FORWARD BLOCK

Sample Time in Seconds

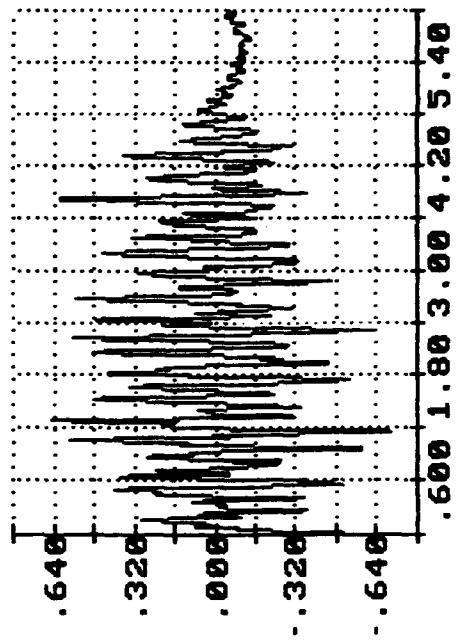
X 1.0000



LONGITUDINAL ACCELERATION  
IN G'S X 1.0000  
ACTION ON MIDDLE BLOCK

Sample Time in Seconds

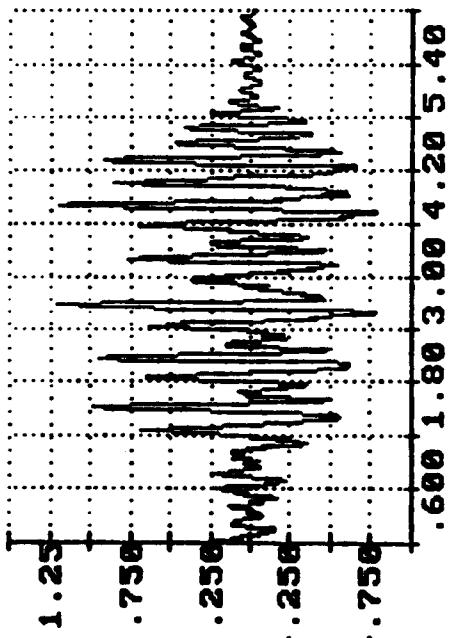
X 1.0000



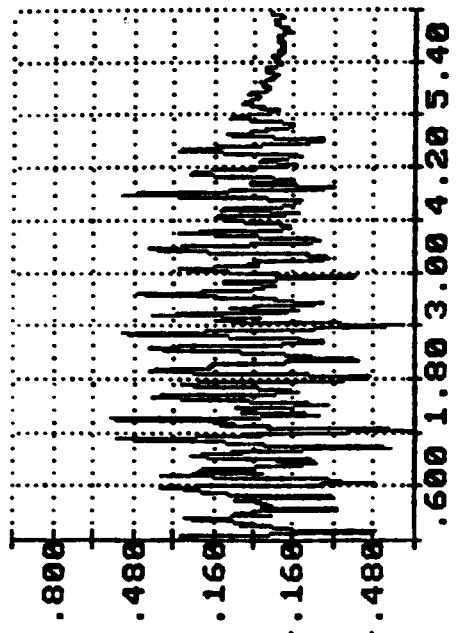
Sample Time in Seconds

X 1.0000

ROAD HAZARD TEST OF ATTACHS ON M871 TRAILER  
DATE: 20 & 21 JULY 1989  
PASS 2, COURSE B

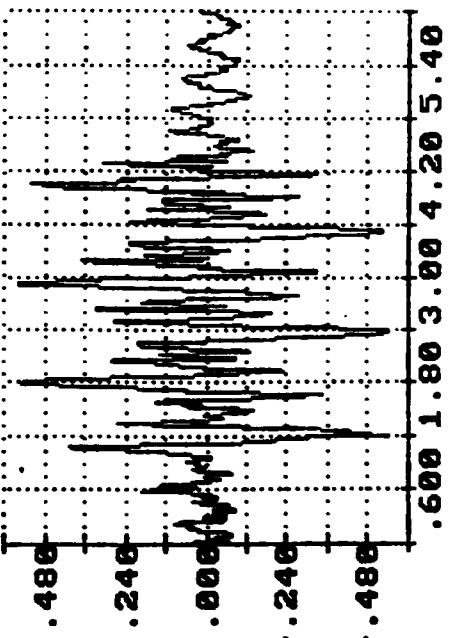


LATERAL ACCELERATION  
ON MIDDLE BLOCK  
IN G'S X 1.0000

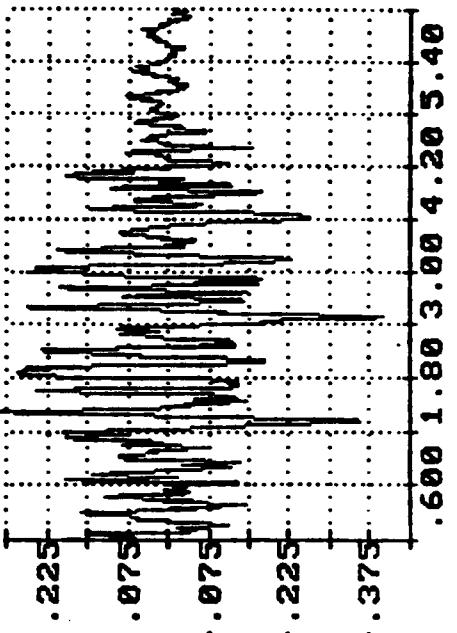


LONGITUDINAL ACCELERATION  
ON MIDDLE BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000



VERTICAL ACCELERATION  
ON MIDDLE BLOCK  
IN G'S X 1.0000

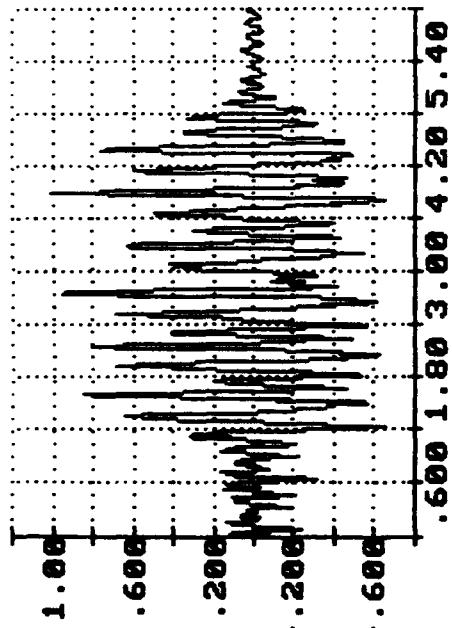


LATERAL ACCELERATION  
ON REAR BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000

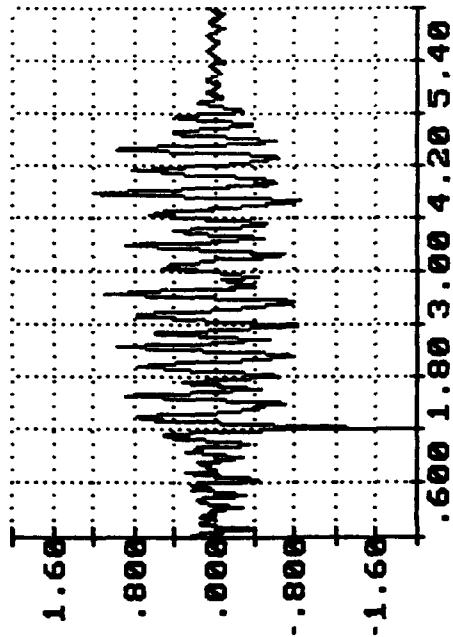
Sample Time in Seconds  
X 1.0000

ROAD HAZARD TEST OF ATACMS ON M871 TRAILER  
DATE: 20 & 21 JULY 1989  
PASS 2, COURSE B



VERTICAL ACCELERATION  
IN ON REAR BLOCK

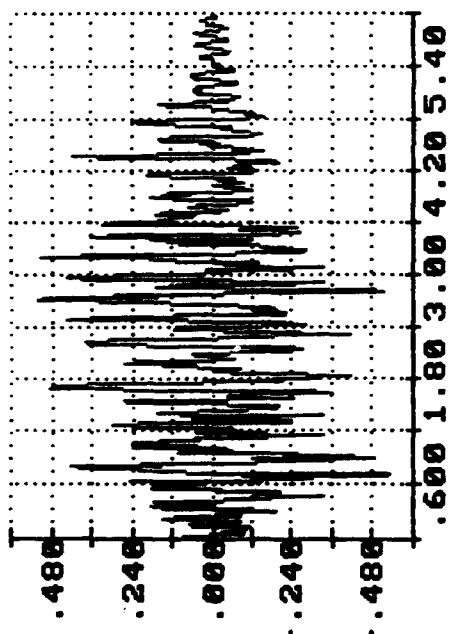
Sample Time in Seconds  
X 1.0000



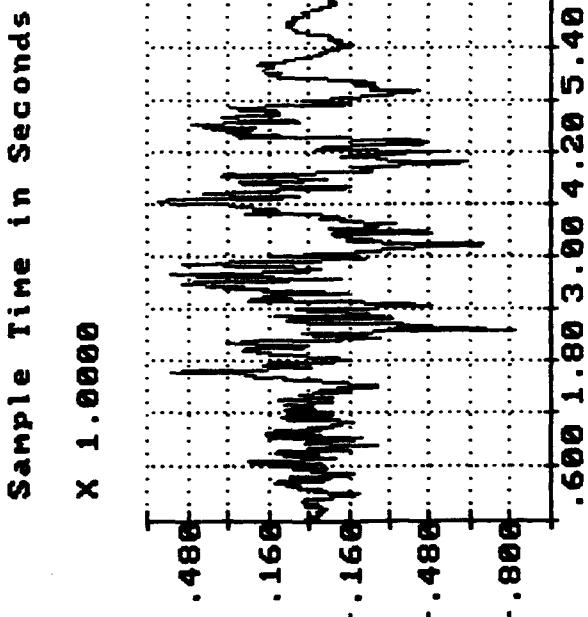
VERTICAL ACCELERATION  
IN ON TRAILER BED

Sample Time in Seconds  
X 1.0000

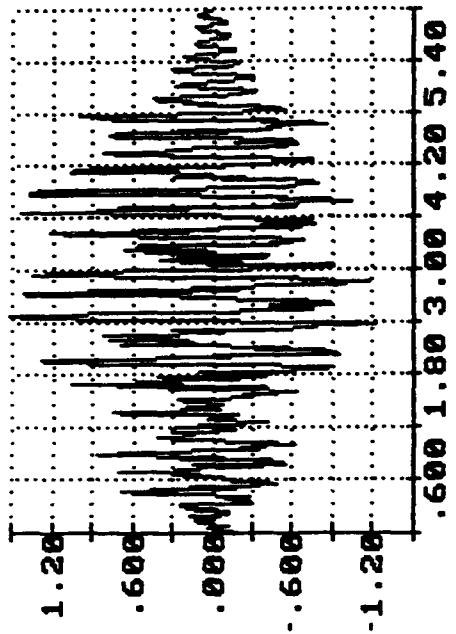
ROAD HAZARD TEST OF ATACMS ON M871 TRAILER  
DATE: 20 & 21 JULY 1989  
PASS 3, COURSE A



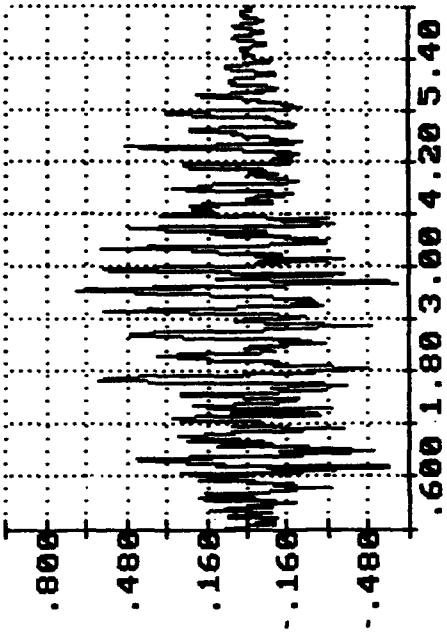
LONGITUDINAL ACCELERATION ON FORWARD BLD IN G.'S X 1.0000



LATERAL ACCELERATION  
ON FORWARD BLOCK  
IN G'S X 1.0000



IN G.S X 1.0000  
N ON FORWARD BLOCK  
URTICAL ACCELERATION

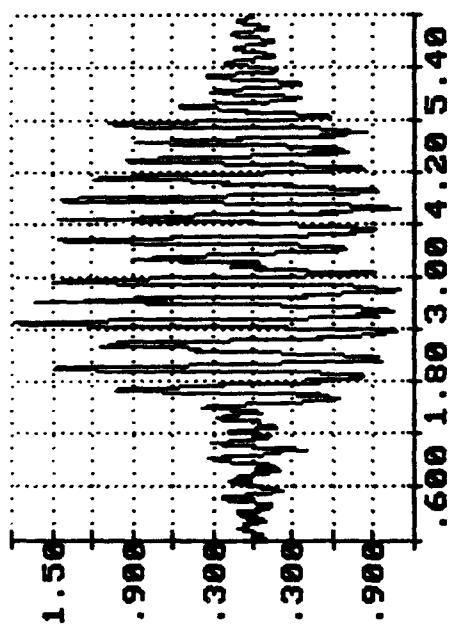


LONGITUDINAL ACCELERATION ON MIDDLE BLOCK IN G.S X 1.0000

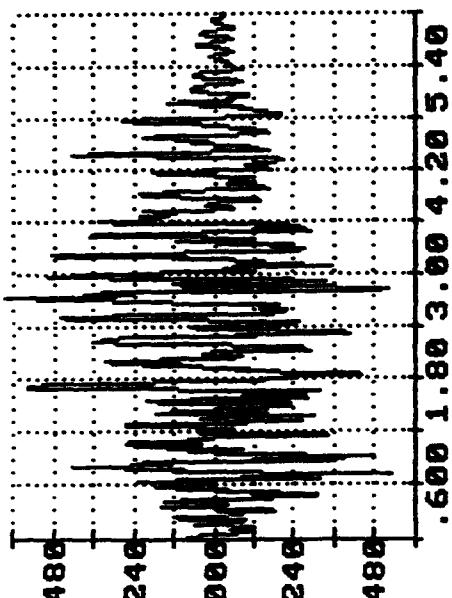


Sample Time in Seconds  
X 1.0000

ROAD HAZARD TEST OF ATACMS ON M871 TRAILER  
DATE: 20 & 21 JULY 1989  
PASS 3, COURSE A

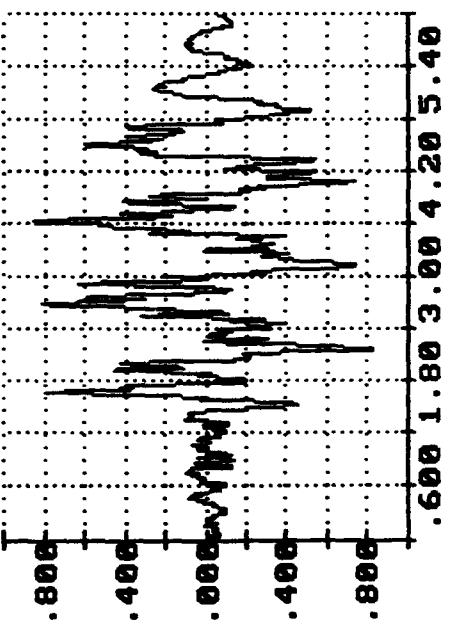


LATERAL ACCELERATION-  
ON MIDDLE BLOCK  
IN G'S X 1.0000



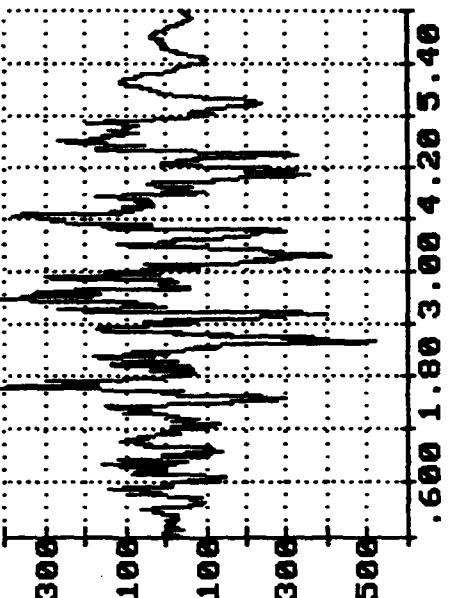
LONGITUDINAL ACCELERATION-  
ON MIDDLE BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000



LATERAL ACCELERATION-  
ON REAR BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000



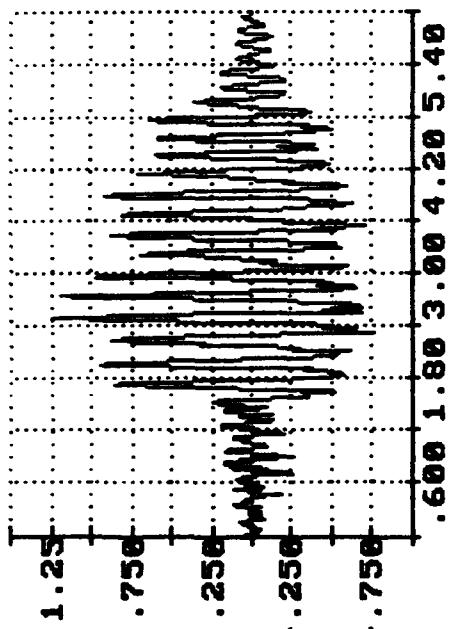
LONGITUDINAL ACCELERATION-  
ON REAR BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000

Sample Time in Seconds  
X 1.0000

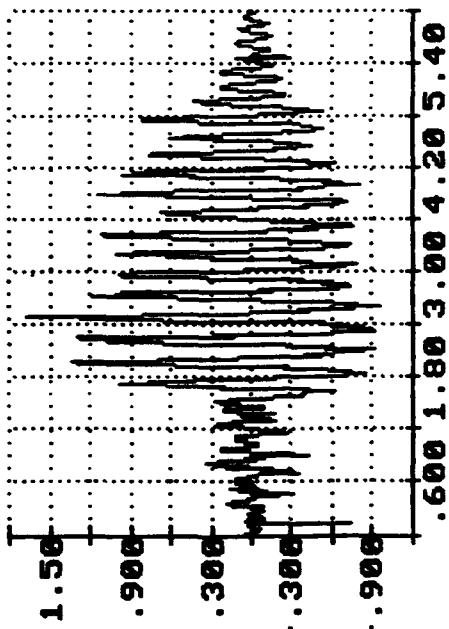
Sample Time in Seconds  
X 1.0000

ROAD HAZARD TEST OF ATACMS ON M871 TRAILER  
DATE: 20 & 21 JULY 1989  
PASS 3, COURSE A



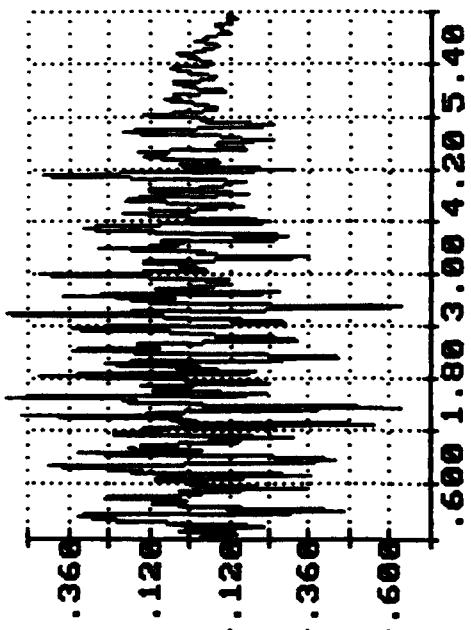
VERTICAL ACCELERATION  
IN ON REAR BLOCK  
IN G'S X 1.0000

SAMPLE TIME IN SECONDS  
X 1.0000

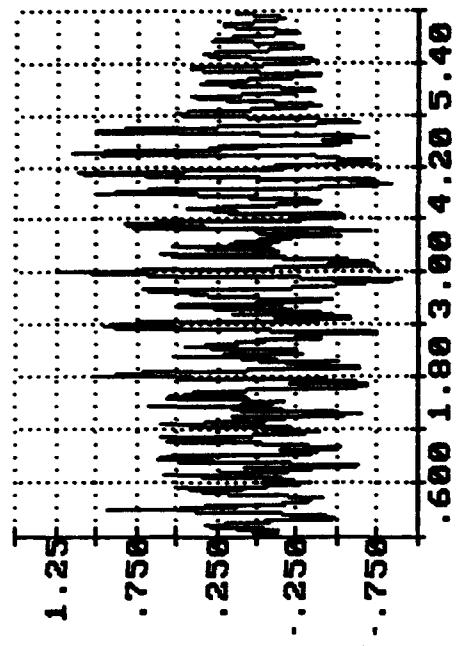


VERTICAL ACCELERATION  
IN ON TRAILER BED  
IN G'S X 1.0000

ROAD HAZARD TEST OF ATTACHS ON M871 TRAILER  
 DATE: 20 & 21 JULY 1989  
 PASS 3, COURSE B

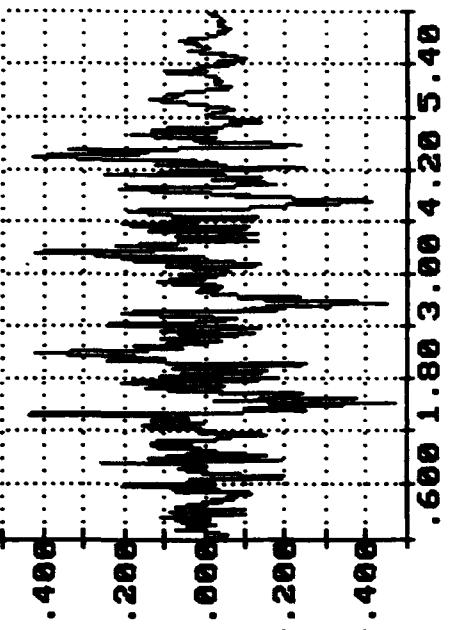


LATERAL ACCELERATION -  
 ON FORWARD BLOCK  
 ATTION ON FORWARD BLOCK  
 IN G'S X 1.0000

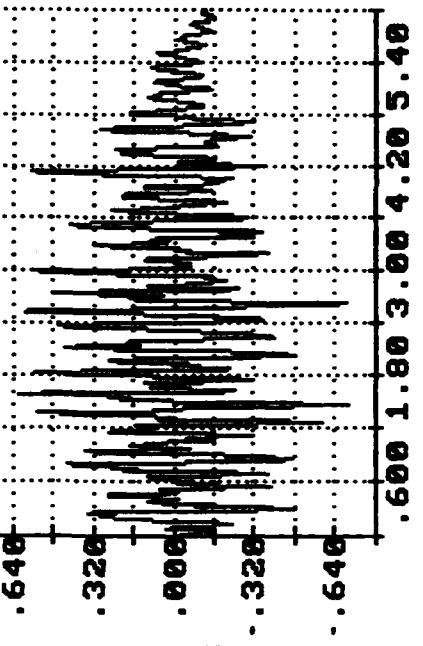


VERTICAL ACCELERATION -  
 IN ON FORWARD BLOCK  
 ATTION ON FORWARD BLOCK  
 IN G'S X 1.0000

Sample Time in Seconds  
 x 1.0000



LATERAL ACCELERATION -  
 ON FORWARD BLOCK  
 ATTION ON FORWARD BLOCK  
 IN G'S X 1.0000



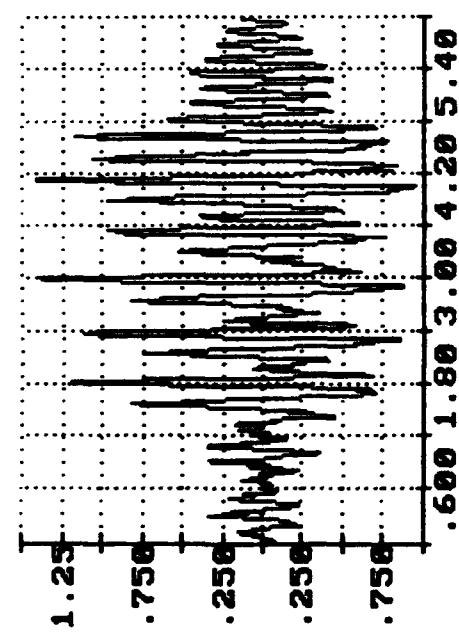
VERTICAL ACCELERATION -  
 IN ON MIDDLE BLOCK  
 ATTION ON MIDDLE BLOCK  
 IN G'S X 1.0000

Sample Time in Seconds  
 x 1.0000

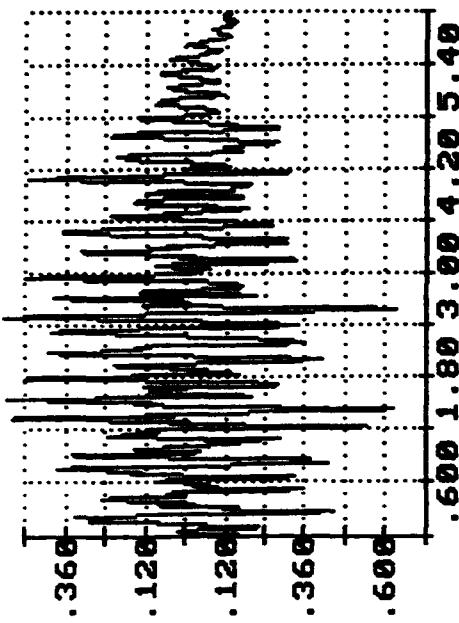
Sample Time in Seconds  
 x 1.0000

Sample Time in Seconds  
 x 1.0000

ROAD HAZARD TEST OF ATACMS ON M871 TRAILER  
DATE: 20 & 21 JULY 1989  
PASS 3, COURSE 3

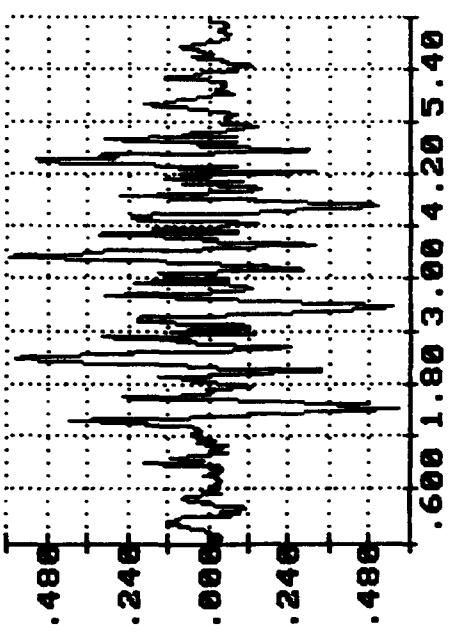


LATERAL ACCELERATION -  
ON MIDDLE BLOCK  
IN G.S X 1.0000



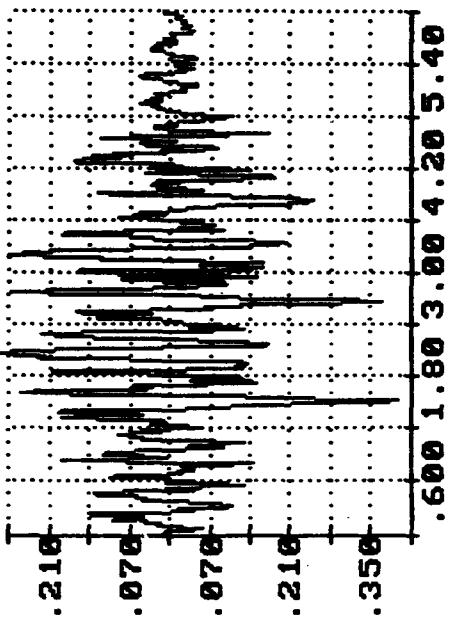
LONGITUDINAL ACCELERATION -  
ATITION ON MIDDLE BLOCK  
IN G.S X 1.0000

Sample Time in Seconds  
X 1.0000



VERTICAL ACCELERATION -  
ON MIDDLE BLOCK  
IN G.S X 1.0000

Sample Time in Seconds  
X 1.0000

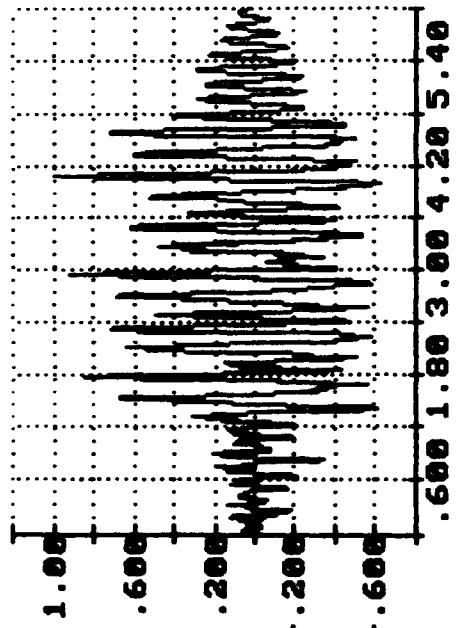


LATERAL ACCELERATION -  
ON REAR BLOCK  
IN G.S X 1.0000

Sample Time in Seconds  
X 1.0000

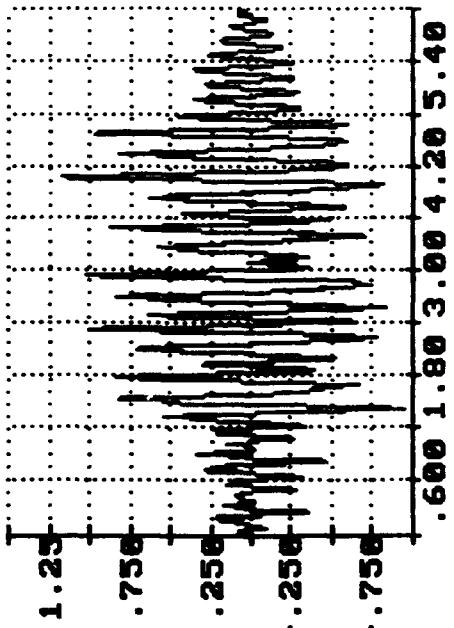
Sample Time in Seconds  
X 1.0000

ROAD HAZARD TEST OF ATTACHS ON M871 TRAILER  
DATE: 20 & 21 JULY 1989  
PASS 3, COURSE B



VERTICAL ACCELERATION  
IN G'S X 1.0000  
ON REAR BLOCK  
IN

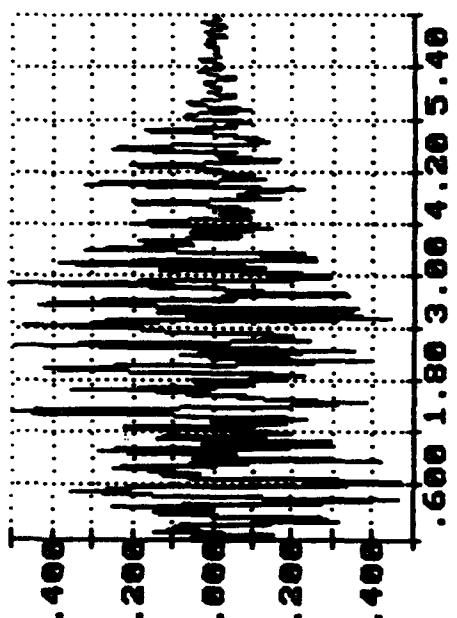
SAMPLE TIME IN SECONDS  
X 1.0000



VERTICAL ACCELERATION  
IN G'S X 1.0000  
ON REAR BLOCK  
IN

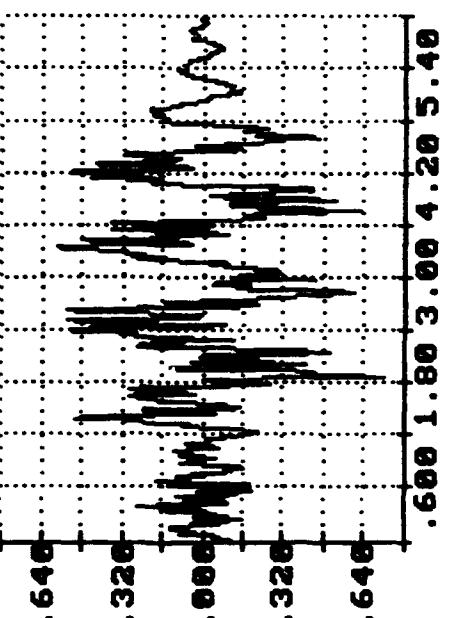
SAMPLE TIME IN SECONDS  
X 1.0000

ROAD HAZARD TEST OF ATACMS ON M871 TRAILER  
DATE: 20 & 21 JULY, 1989  
PASS 4, COURSE A

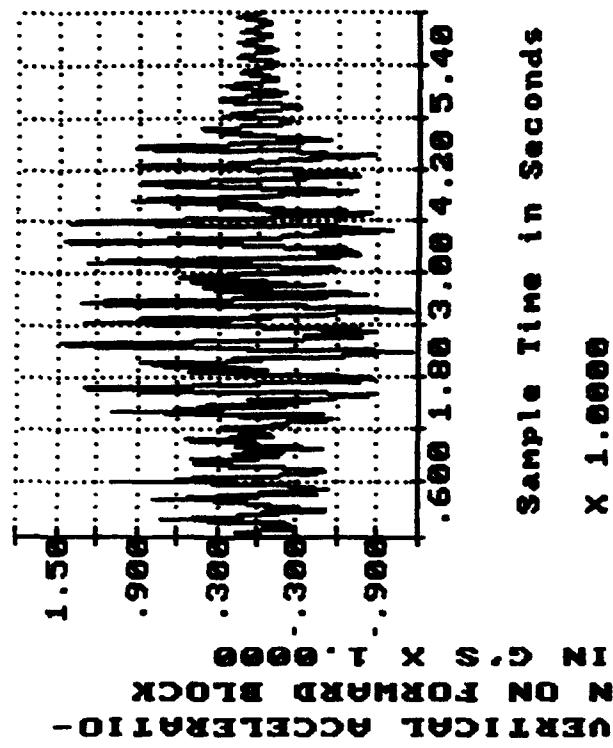


LONGITUDINAL ACCELERATION  
ON FORWARD BLOCK  
IN G.S X 1.0000

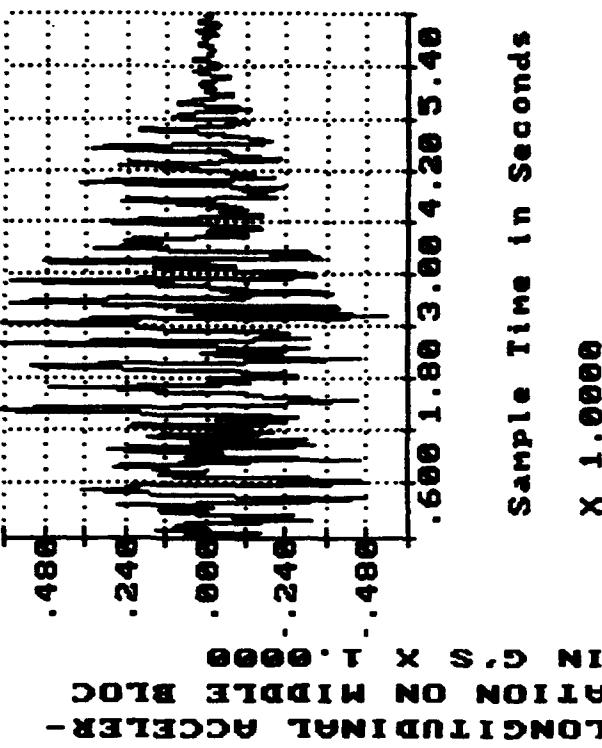
Sample Time in Seconds  
X 1.0000  
.600 1.80 3.00 4.20 5.40  
.400  
.200  
.000  
.200  
.400



LATERAL ACCELERATION  
ON FORWARD BLOCK  
IN G.S X 1.0000



VERTICAL ACCELERATION  
ON FORWARD BLOCK

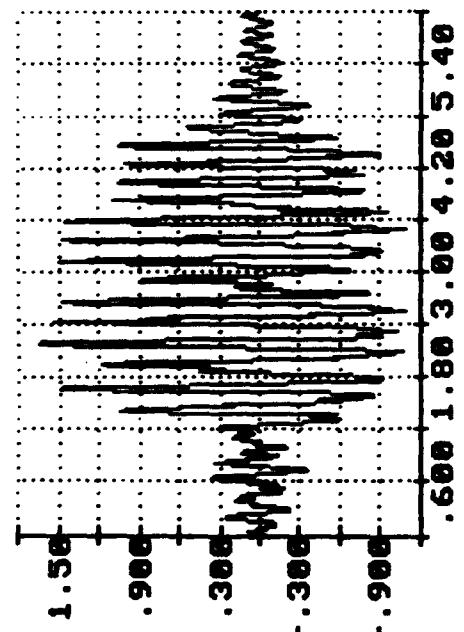


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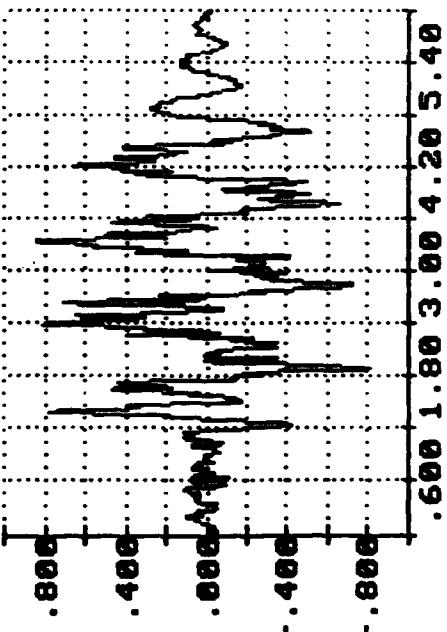
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ROAD HAZARD TEST OF ATTACHS ON M871 TRAILER  
DATE: 20 & 21 JULY 1989  
PASS 4, COURSE A



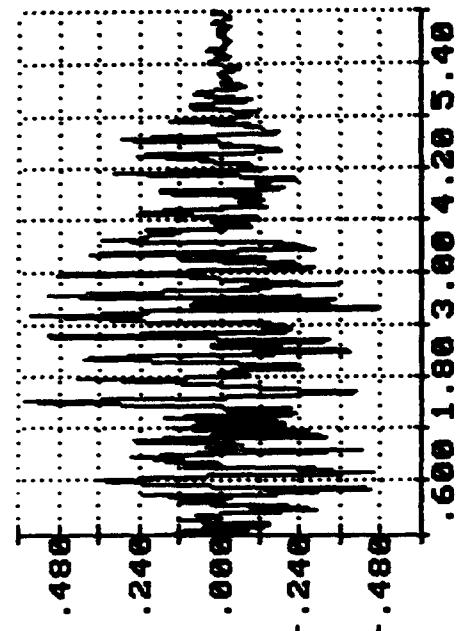
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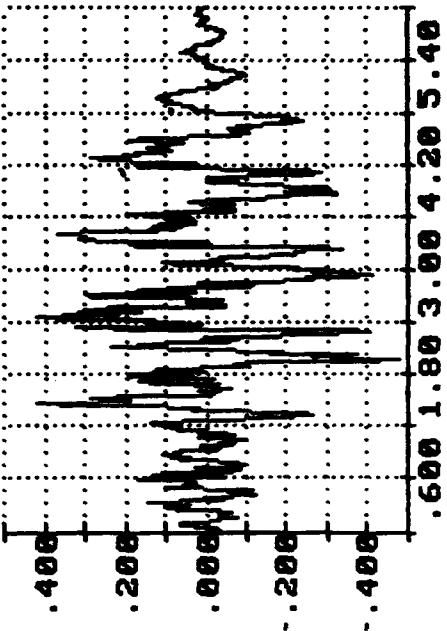
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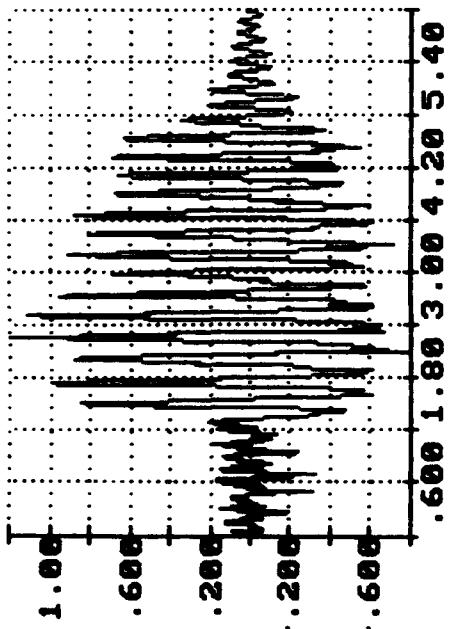
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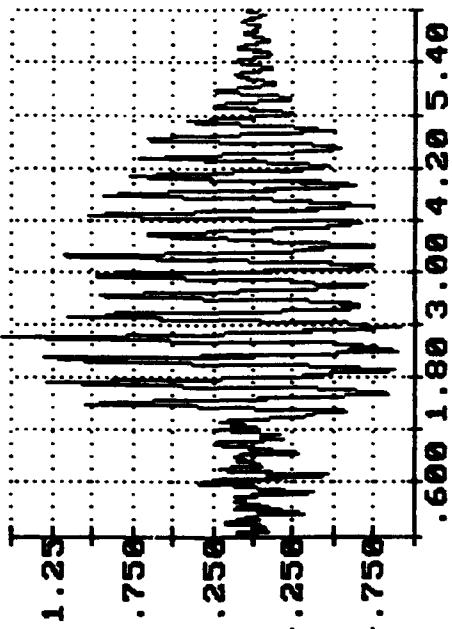
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DATE: 20 & 21 JULY 1989  
PASS 4, COURSE A



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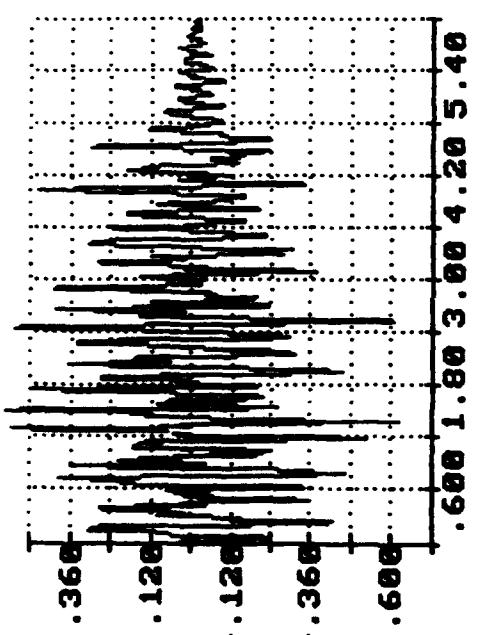
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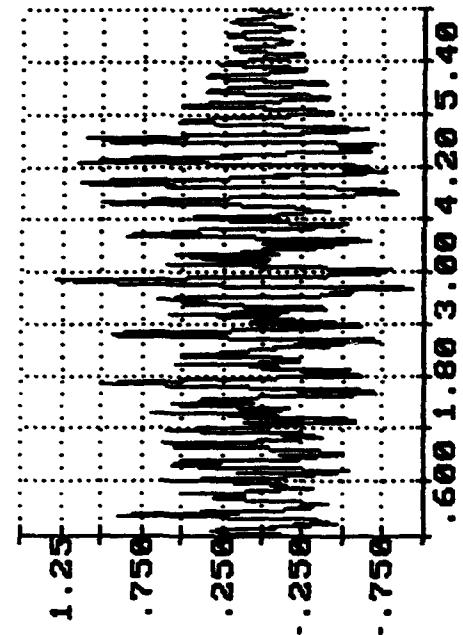
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PASS 4, COURSE B

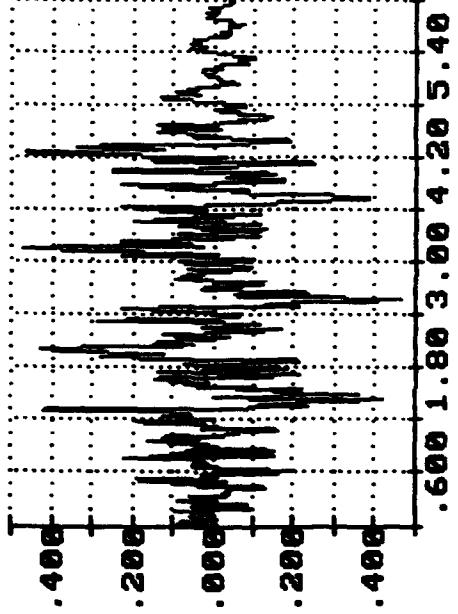


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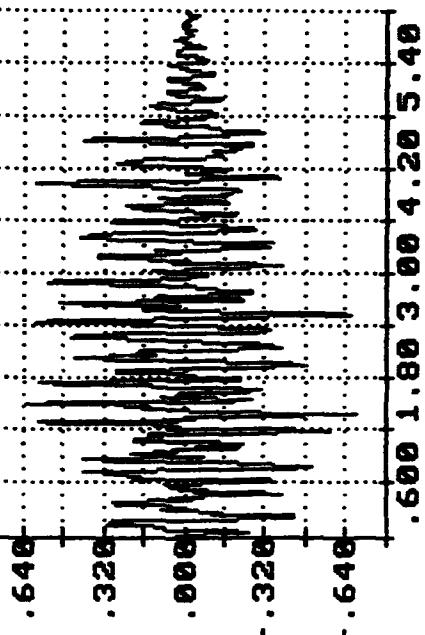
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Sample Time in Seconds  
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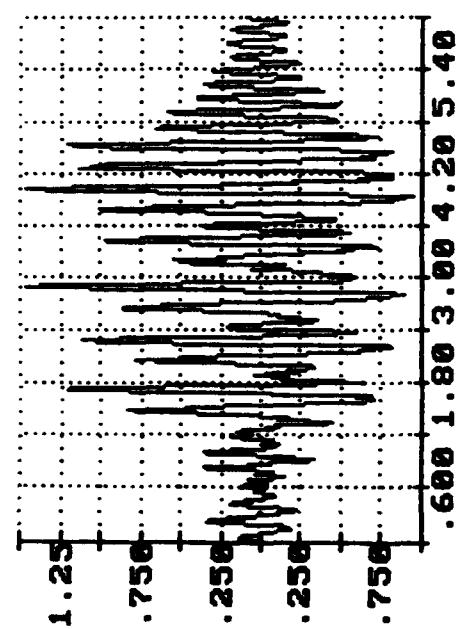


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Sample Time in Seconds  
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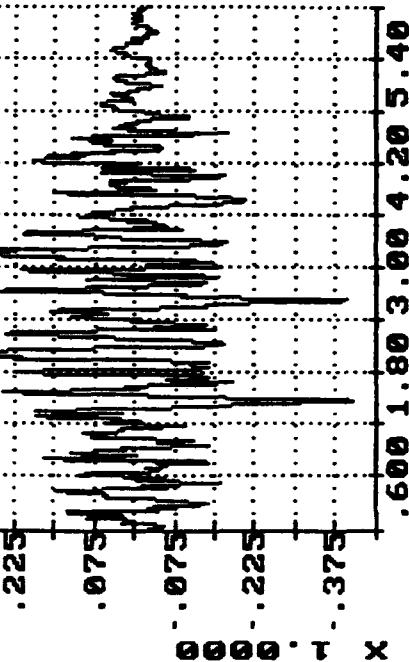
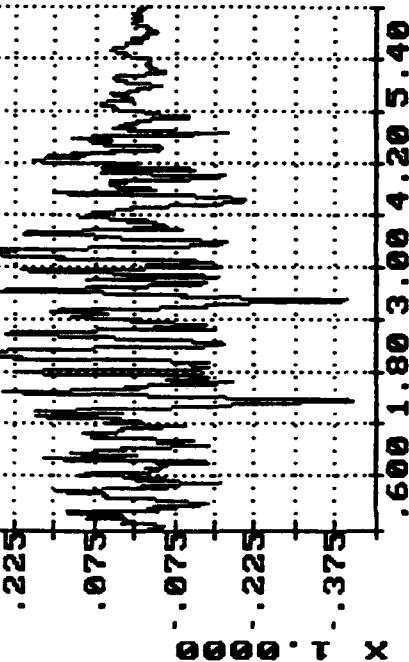
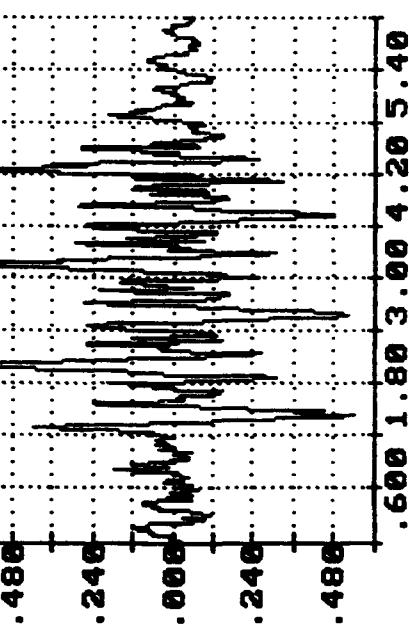
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ROAD HAZARD TEST OF ATACMS ON M871 TRAILER  
DATE: 20 & 21 JULY 1989  
PASS 4, COURSE B



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IN G.S X 1.00000



Sample Time in Seconds  
X 1.00000

X 1.00000

Sample Time in Seconds  
X 1.00000

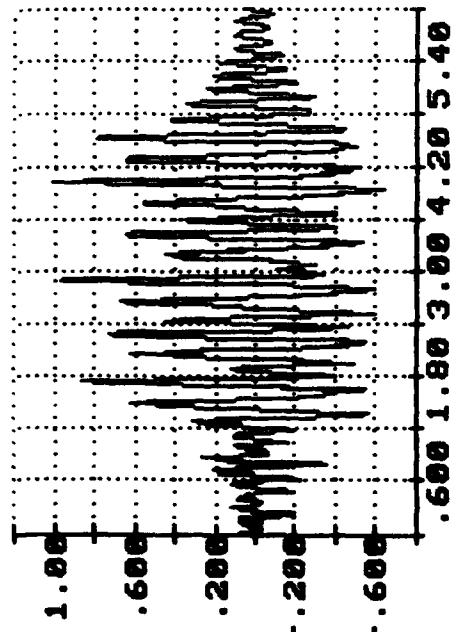
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IN G.S X 1.00000

IN G.S X 1.00000

ROAD HAZARD TEST OF ATTACHS ON M871 TRAILER  
DATE: 20 & 21 JULY 1989  
PASS 4, COURSE B



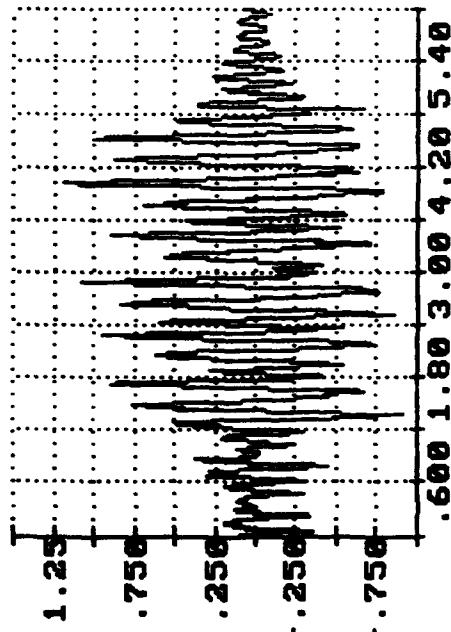
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ON REAR BLOCK

IN G'S X 1.0000

ON TRAILER BED

IN G'S X 1.0000



VERTICAL ACCELERATION  
IN G'S X 1.0000

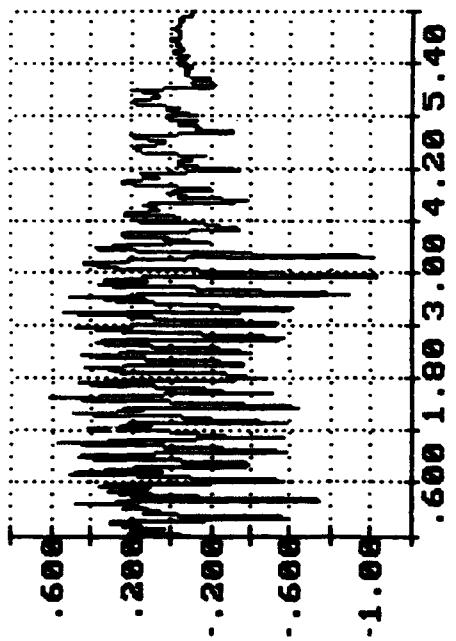
ON REAR BLOCK

IN G'S X 1.0000

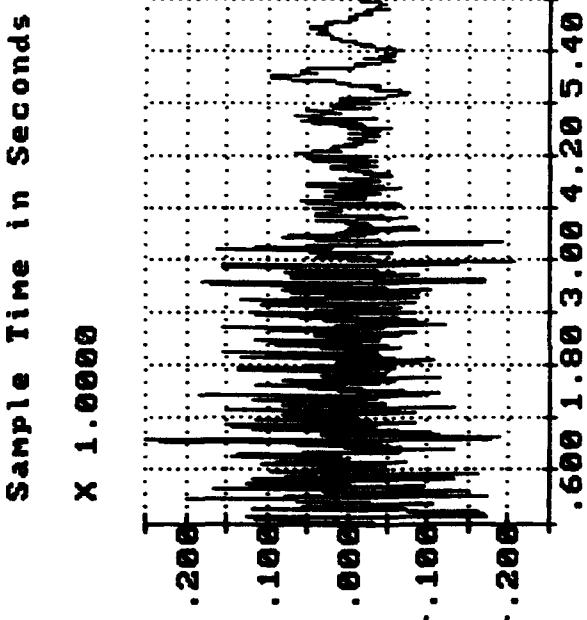
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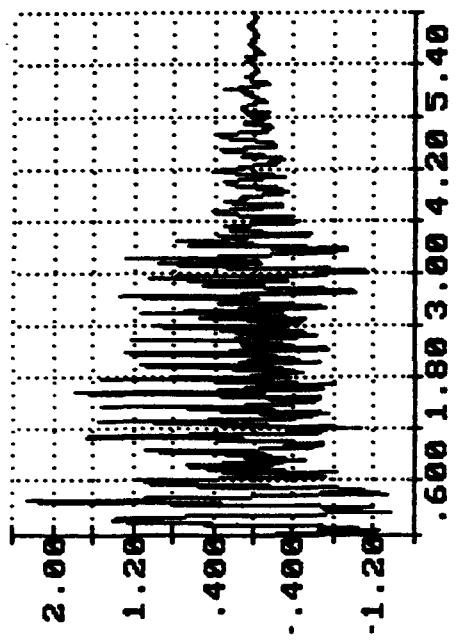
ROAD HAZARD TEST OF ATACMS ON M871 TRAILER  
DATE: 20 & 21 JULY 1989  
WASHBOARD COURSE



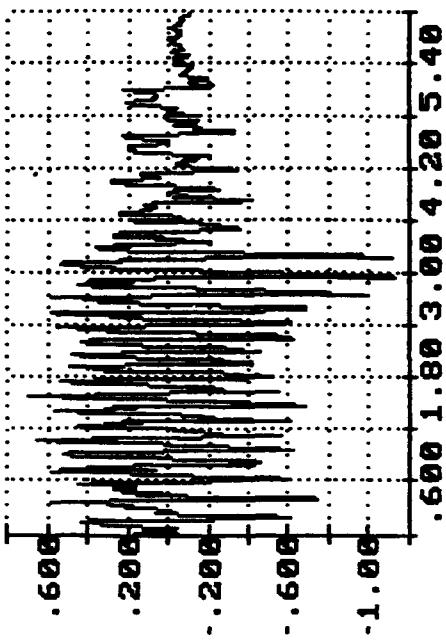
LONGITUDINAL ACCELERATION ON FORWARD BLO  
IN G.S X 1.0000



IN G.S. X 1.0000  
ON FORWARD BLOCK  
FEDERAL ACCENTRATION-



IN G.S X 1.0000  
N ON FORWARD BLOCK  
VERTICAL ACCELERATION

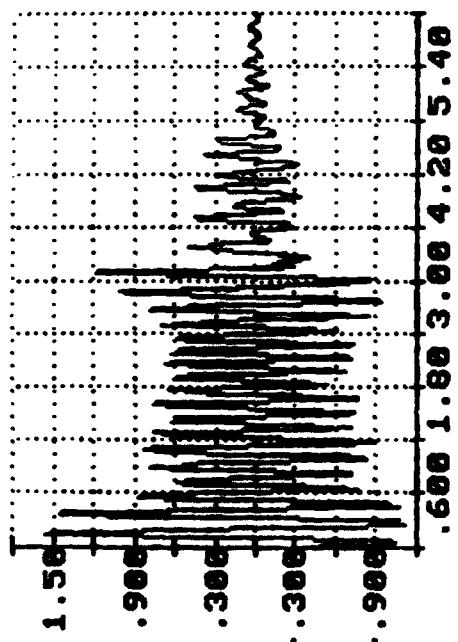


LONGITUDINAL ACCELERATION ON MIDDLE BLOCK IN G'S X 1.0000

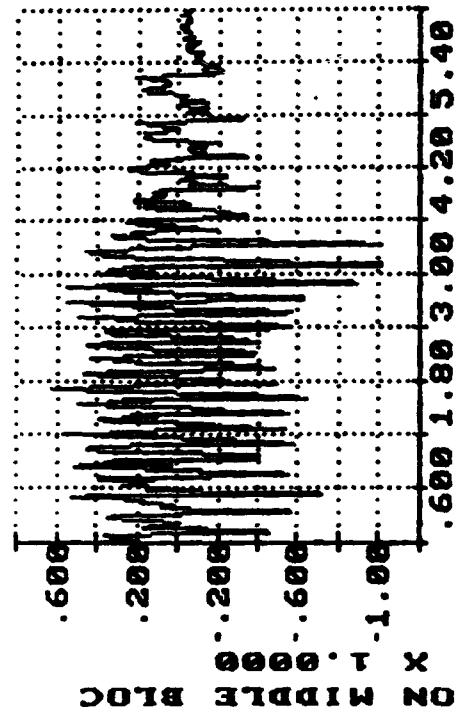


Sample Time in Seconds

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DATE: 20 & 21 JULY 1989  
WASHBOARD COURSE



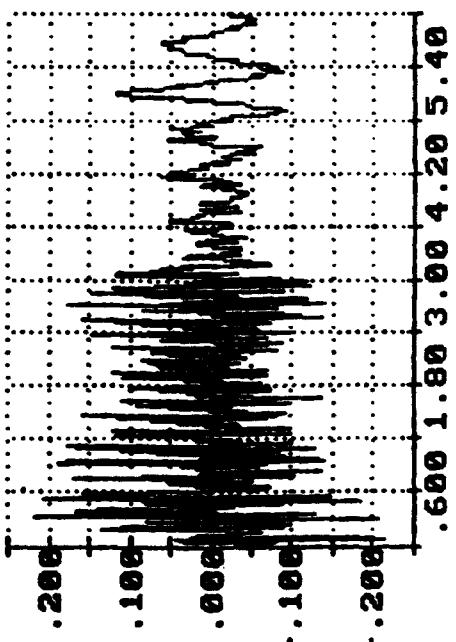
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LONGITUDINAL ACCELERATION  
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Sample Time in Seconds

X 1.0000



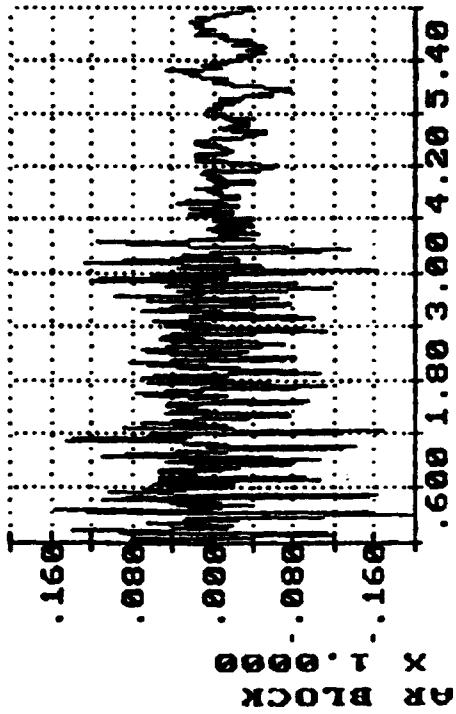
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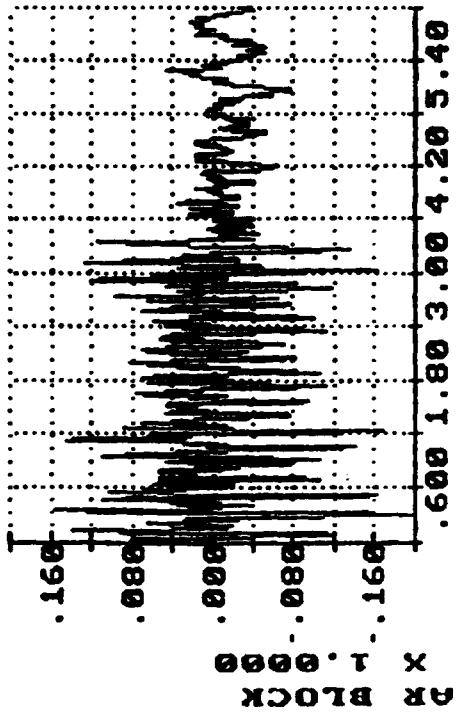
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Sample Time in Seconds

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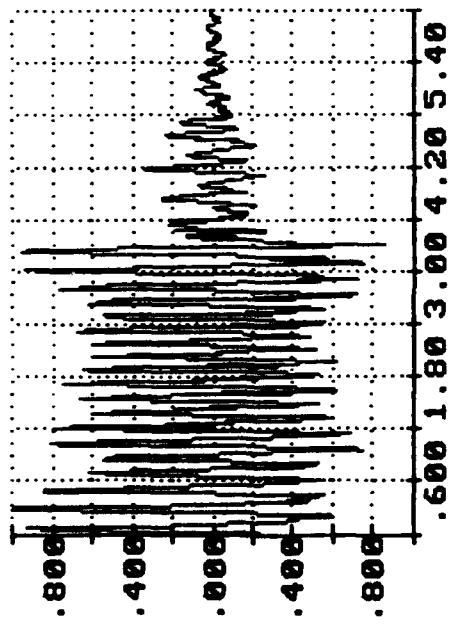


LATERAL ACCELERATION  
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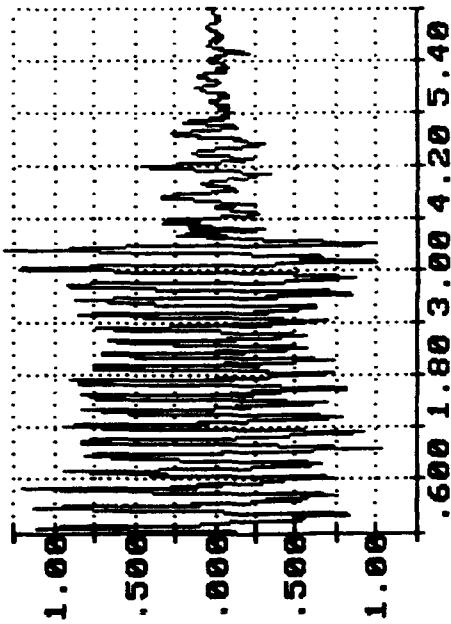
LONGITUDINAL ACCELERATION  
ON REAR BLOCK  
IN G'S X 1.0000

ROAD HAZARD TEST OF ATACMS ON M871 TRAILER  
DATE: 20 & 21 JULY 1989  
WASHBOARD COURSE



VERTICAL ACCELERATION  
IN ON REAR BLOCK  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000



VERTICAL ACCELERATION  
IN ON TRAILER BED  
IN G'S X 1.0000

Sample Time in Seconds  
X 1.0000

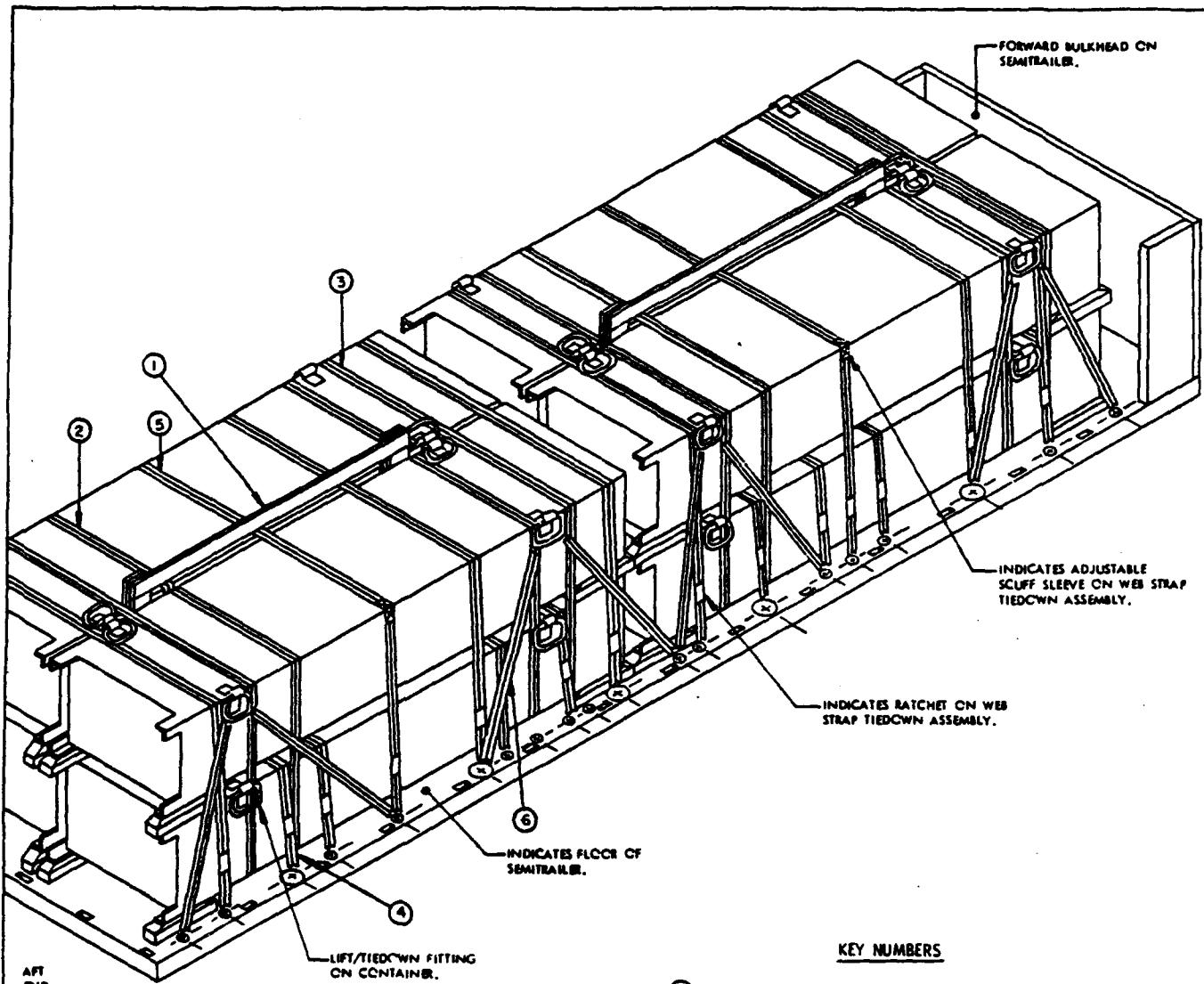
**PART 5**  
**BLOCKING AND BRACING PROCEDURES**

MLRS

# LOADING, TIEDOWN, AND UNLOADING PROCEDURES FOR THE LAUNCH POD/CONTAINER (LP/C) FOR THE MULTIPLE LAUNCH ROCKET SYSTEM IN/ON TACTICAL VEHICLES

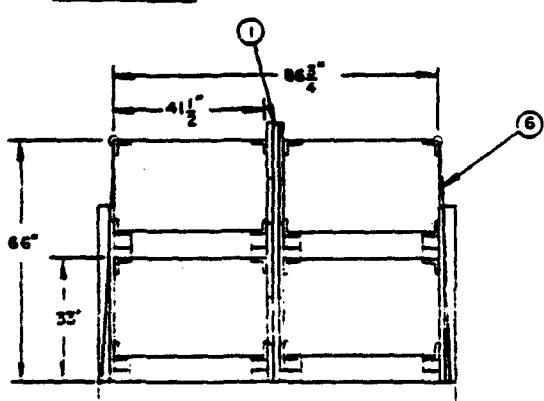
## **INDEX**

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TWO CONTAINERS (METHOD I)	5
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#### KEY NUMBERS

- ① SPACER ASSEMBLY (2 REQD). SEE THE DETAIL ON PAGE 10.
- ② WEB STRAP TIEDOWN ASSEMBLY (8 REQD). INSTALL TO ENCLOSE THE TWO (2) CONTAINERS IN THE TWO-HIGH STACKS AS SHOWN.
- ③ WEB STRAP TIEDOWN ASSEMBLY (4 REQD). EACH ASSEMBLY WILL CONSIST OF TWO WEB STRAPS HOOKED TOGETHER. INSTALL EACH ASSEMBLY TO ENCLOSE FOUR CONTAINERS, AS SHOWN. SEE GENERAL NOTE "K" ON PAGE 2.
- ④ WEB STRAP TIEDOWN ASSEMBLY (8 REQD). INSTALL TO EXTEND FROM A TIEDOWN FITTING ON SIDE OF THE SEMITRAILER, OVER THE BOTTOM CONTAINERS, TO A TIEDOWN FITTING ON THE OPPOSITE SIDE OF THE SEMITRAILER. NOTE: POSITION THESE STRAPS WITH THE STRAP RATCHETS ON THE SAME SIDE OF THE SEMITRAILER. SEE GENERAL NOTE "M" ON PAGE 2.
- ⑤ WEB STRAP TIEDOWN ASSEMBLY (8 REQD). INSTALL TO EXTEND FROM A TIEDOWN FITTING ON SIDE OF THE SEMITRAILER, OVER THE CONTAINERS TO A TIEDOWN FITTING ON THE OPPOSITE SIDE OF THE SEMITRAILER. NOTE: POSITION THESE STRAPS WITH THE STRAP RATCHETS ON THE SAME SIDE OF THE SEMITRAILER. SEE GENERAL NOTES "M" AND "N" ON PAGE 2.
- ⑥ WEB STRAP TIEDOWN ASSEMBLY (16 REQD). INSTALL AT ANGLE SHOWN, TO EXTEND FROM A TIEDOWN FITTING ON THE TOP CONTAINER TO A TIEDOWN FITTING ON THE SIDE OF THE SEMITRAILER. SEE GENERAL NOTE "P" ON PAGE 2.



REAR VIEW

KEY NUMBERS ②, ③, ④, AND ⑥  
HAVE BEEN OMITTED FOR CLARITY.

#### GENERAL NOTES

- A. THIS DOCUMENT HAS BEEN PREPARED AND ISSUED IN ACCORDANCE WITH AR 740-1.
- B. THIS DRAWING COVERS PROCEDURES APPLICABLE TO THE TRANSPORT OF THE LAUNCH POD/CONTAINERS (LPC) FOR MULTIPLE LAUNCH ROCKET SYSTEM (MLRS), IN/ON TACTICAL TYPE VEHICLES. IF OTHER TYPES OF CARGO ITEMS ARE TRANSPORTED WITH THAT SHOWN, THE TOTAL LOAD MUST BE COMPATIBLE AND THE ADDED ITEMS MUST BE SECURED WITH WEB STRAP ASSEMBLIES, AS REQUIRED TO PREVENT DISPLACEMENT DURING TRANSPORTATION.
- C. DEPICTED PROCEDURES APPLY TO THE VEHICLES DESIGNATED HEREIN, MODIFIED TO INCLUDE THE UNIVERSALLY APPLICABLE "TIE DOWN KIT" WHICH CONSISTS OF THE TIE DOWN FITTINGS OR ANCHOR DEVICES, FOR INSTALLATION IN/ON CARGO BEDS, AND WEB STRAP TIE DOWN ASSEMBLIES, OR MODIFIED TO INCLUDE A SPECIAL "CARGO TIEDOWN KIT" AND WEB STRAP TIEDOWN ASSEMBLIES.
- D. AS APPLICABLE TO THE PROCEDURES SHOWN ON PAGES 4 THROUGH 10, WHENEVER POSSIBLE, A LOAD SHOULD BE CENTERED LATERALLY IN/ON CARRYING VEHICLE TO PROVIDE FOR EQUAL ANGLE HOLD DOWN BY THE SECURING WEB STRAP ASSEMBLIES. WHENEVER POSSIBLE, LADING SHOULD BE POSITIONED AGAINST THE FRONT WALL OF THE VEHICLE OR CENTERED LONGITUDINALLY IN/ON THE CARRYING VEHICLE BETWEEN THE SELECTED TIE DOWN FITTINGS TO BE USED. HOWEVER, DUE TO LADING WEIGHT, LADING LENGTH, LADING CONFIGURATION AND/OR LOCATION AND QUANTITY OF TIEDOWN ANCHORS WITHIN THE CARRYING VEHICLE IT MAY BE NECESSARY TO LOCATE THE LADING LONGITUDINALLY IN/ON VEHICLE AS SHOWN WITHIN THIS DRAWING TO PROVIDE FOR PROPER TIEDOWN AND TO ACHIEVE A MAXIMUM LOAD.
- E. WEB STRAP TIEDOWN ASSEMBLIES MUST BE SECURELY HOOKED INTO ANCHORING DEVICES ON THE TRANSPORTING VEHICLE AND FIRMLY TENSIONED. ALSO, WHEN ONE ITEM IS UNITIZED TO ANOTHER, THE HOOKS ON A STRAP MUST BE SECURELY ENGAGED AND THE STRAP FIRMLY TENSIONED. EXERCISE CARE DURING STRAP APPLICATION; AVOID TWISTS IN STRAP TO THE EXTENT POSSIBLE (IF TIME PERMITS) BUT INSURE THERE ARE NO KNOTS IN STRAP. ON THE TAKE-UP SPOOL OF RATCHET, INSURE STRAIGHT LAY OF STRAP WHEN TENSIONING. THE TENSIONED STRAP MUST FORM AT LEAST ONE AND ONE-HALF COMPLETE WRAPS ON THE TAKE-UP SPOOL OF THE TENSIONING RATCHET. TIE BACK THE LOOSE END OF STRAP AFTER TENSIONING IS COMPLETED (LOOSE END MAY BE FOLDED AND TAPE OR TIED TO THE TENSION STRAP IF TIME PERMITS).
- F. ADJUSTABLE SCUFF SLEEVES PROVIDED ON WEB STRAP ASSEMBLIES WILL BE LOCATED TO PROVIDE PAD WHERE STRAPS PASS OVER SHARP EDGES OR RATCHETS AND HOOKS ON PREVIOUSLY INSTALLED WEB STRAP TIEDOWN ASSEMBLIES. METAL PARTS OF A STRAP ASSEMBLY SHOULD BE LOCATED SO AS TO AVOID CONTACT WITH THE CARGO. IF CONTACT CANNOT BE AVOIDED, A SUITABLE ANTI-CHAFING MATERIAL, AS LISTED UNDER THE MATERIAL SPECIFICATIONS BELOW, MUST BE POSITIONED BETWEEN THE METAL PARTS OF A STRAP ASSEMBLY AND THE CARGO AND IF NECESSARY, TAPE OR TIE IN POSITION. IF THE WEB STRAP TIEDOWN ASSEMBLIES BEING USED ARE NOT EQUIPPED WITH ADJUSTABLE SCUFF SLEEVES A SUITABLE ANTI-CHAFING MATERIAL, AS LISTED IN THE MATERIAL SPECIFICATIONS BELOW, MUST BE POSITIONED BETWEEN THE STRAP AND ALL SHARP EDGES AND IF NECESSARY, TAPE OR TIE IN POSITION.
- G. CONTAINER DETAIL:  
DIMENSIONS: —— 13'-10" LONG BY 41-1/2" WIDE BY 33" HIGH.  
GROSS WEIGHT: —— 5,078 POUNDS (APPROX.).
- H. IF THE SIDE RACKS FOR A SEMI-TRAILER ARE TO BE TRANSPORTED ON THE LOADED TRAILER, THEY WILL BE STACKED ON THE TRAILER AND SECURED WITH A SUFFICIENT QUANTITY OF WEB STRAP TIE DOWN ASSEMBLIES TO PREVENT LOSS DURING TRANSPORT. SIDE RACKS FOR THE M81 AND M82 SEMI-TRAILERS MAY BE POSITIONED AGAINST THE FORWARD BULIDHEAD AND SECURED WITH WEB STRAP TIEDOWN ASSEMBLIES, OR INSTALLED ON THE TRAILERS IN THE APPROVED MANNER.
- J. ITEM LOCATION AND QUANTITIES OF THE DESIGNATED ITEM MAY BE VARIED TO SATISFY OPERATIONAL REQUIREMENTS, PROVIDED LOADING AND TIEDOWN PRINCIPLES SPECIFIED HEREIN ARE RETAINED AND A VEHICLE IS NOT OVERLOADED.  
CAUTION: CONTAINERS MUST NOT BE STACKED MORE THAN TWO HIGH.
- K. WHEN ONE WEB STRAP TIEDOWN ASSEMBLY IS NOT LONG ENOUGH TO SPAN THE DISTANCE REQUIRED, TWO ASSEMBLIES MAY BE HOOKED TOGETHER TO GAIN THE NECESSARY LENGTH.

(CONTINUED AT RIGHT)

#### MATERIAL SPECIFICATIONS\*

- STRAP: WEBBING, UNIVERSAL TIE DOWN, NSN 5340-01-089-4997, PN 11669580.
- ANTI-CHAFING MATERIAL: CANVAS, BURLAP, TAPE OR ANY OTHER SUITABLE MATERIAL.
- LUMBER: BM 740-200-1 (DUNNAGE LUMBER, FED SPEC NM-L-751).
- NAILS: FED SPEC FM-7-105: COMMON.

\* ADDITIONAL SPECIFICATIONS THAT ARE APPLICABLE TO A SPECIAL "CARGO TIEDOWN KIT" ARE REFLECTED ON PAGE 10.

#### (GENERAL NOTES CONTINUED)

- L. ONLY THE CARGO BODIES OR BEDS OF THE TACTICAL VEHICLES HAVE BEEN SHOWN HEREIN, TO PREVENT DISTRACTION FROM THE DELINEATED LOADING AND TIEDOWN PROCEDURES, AND ARE SHOWN IN ISOMETRIC FORM WITH THE STRUCTURAL PORTIONS OMITTED AS NECESSARY TO IMPROVE THE CLARITY OF THE DEPICTED PROCEDURES.
- M. SOME TIEDOWN METHODS WITHIN THIS DRAWING SHOW TWO OR MORE TIEDOWN STRAPS CONNECTED TO ONE VEHICLE TIEDOWN FITTING. THIS IS AUTHORIZED AS SPECIFIED HEREIN. THE APPLIED FORCES WILL NOT EXCEED THE DESIGN STRENGTH OF THE FITTING.
- N. WHEN POSSIBLE, ALL OF THE HOLD-DOWN WEB STRAP ASSEMBLIES SHOULD BE POSITIONED WITH THE STRAP RATCHETS LOCATED ON THE SAME SIDE OF THE LOAD. THIS METHOD WILL AID IN REDUCING THE TIME REQUIRED TO LOAD AND UNLOAD A VEHICLE.
- O. THE LOADS ON PAGES 6, 7, AND 8 SHOW A "SPACER ASSEMBLY" POSITIONED BETWEEN LATERALLY ADJACENT CONTAINERS. THE SPACER ASSEMBLY IS REQUIRED TO PROVIDE A SPACE BETWEEN THE CONTAINERS FOR THE LIFT/TIEDOWN FITTING BRACKET, WHICH PROJECTS 3/4" OUT FROM SIDE OF CONTAINER. NOTE: THE "SPACER ASSEMBLY" MAY BE OMITTED FOR "EMERGENCY LOGISTIC MOVEMENT" AND THE CONTAINERS MAY BE OFF-SET SO THE LIFT/TIEDOWN-FITTING BRACKETS ARE NOT LATERALLY ADJACENT TO EACH OTHER.
- P. THE LOADING AND TIEDOWN PROCEDURES FOR THE M985 10 TON TRUCK AND THE M989 11 TON TRAILER, AS DELINEATED ON PAGES 11 THRU 22, ARE SPECIFICALLY APPLICABLE TO WEAPON SUPPORT/RESUPPLY OPERATIONS. PROCEDURES, AS SPECIFIED FOR BOTH OF THESE VEHICLES, DEPEND ON THE USE OF A SPECIAL CARGO SECUREMENT KIT (FLOOR-MOUNTED DEVICES) THAT HAS BEEN IMPLEMENTED TO SPECIFICALLY ENHANCE WEAPON SUPPORT/RESUPPLY OPERATIONS. ALTHOUGH THE PROCEDURES SPECIFIED ARE SPECIFICALLY APPLICABLE TO WEAPON SUPPORT/RESUPPLY OPERATIONS THEY CAN ALSO BE USED WITHIN OTHER SEGMENTS OF MLRS L/C SUPPLY TRAINS IF CARGO SECUREMENT KITS ARE INSTALLED ON THE M985 AND/OR M989 VEHICLES USED IN THESE TRAINS.
- Q. CAUTION: EXTRA CARE MUST BE TAKEN BY THE VEHICLE OPERATOR (DRIVER) WHEN MOVING A LOADED VEHICLE AND A LOAD UNIT (STACK) ON THE VEHICLE CONTAINS THREE MLRS PODS, AS SHOWN ON PAGES 7, 13 AND 17. A 3-POD LOAD UNIT CAUSES THE TRANSPORTING VEHICLE TO BE HEAVIER ON ONE SIDE AND, THUSLY, MORE UNSTABLE REGARDING VEHICLE TIP OVER. THE REQUIRED EXTRA CARE IS ESPECIALLY APPLICABLE TO THE LOADS DELINEATED ON PAGES 13 AND 17.

#### REVISIONS

REVISION NO. 1, DATED JANUARY 1981, CONSISTS OF:

1. ADDING SPECIAL TIEDOWN PROCEDURES FOR THE MLRS L/C IN/ON THE TRUCK, HEAVY EXPANDED MOBILITY, 10 TON M985, AND THE TRAILER, HEAVY EXPANDED MOBILITY, 11 TON, M989.
2. UPDATED GENERAL NOTES, MATERIAL SPECIFICATIONS, AND DRAWINGS FORMAT.

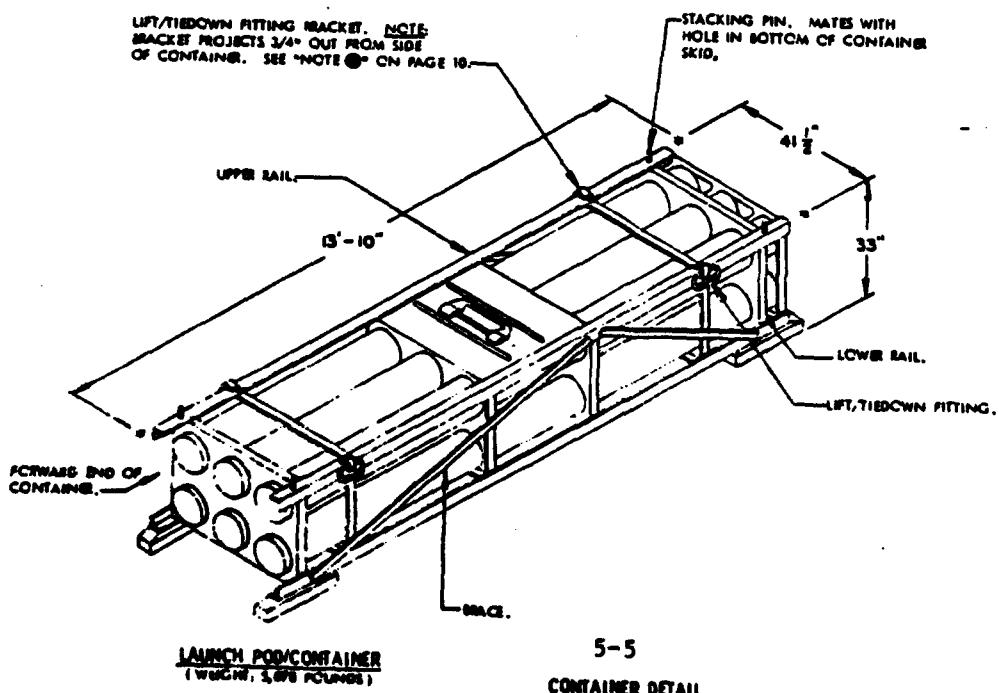
SPECIAL NOTES: (FOR LOADS/VEHICLES SHOWN ON PAGES 4 THROUGH 8)

1. ONLY MAXIMUM LOADS ARE SHOWN FOR THE VEHICLES AND/OR TRAILERS LISTED IN THE CHART AT THE RIGHT. THE MAXIMUM QUANTITY OF CONTAINERS IN A LOAD IS BASED ON THE WEIGHT LIMIT OF THE VEHICLE AND/OR ON THE SIZE OF THE VEHICLE. SEE THE "LOAD PLANNING GUIDANCE FOR ONE THROUGH EIGHT CONTAINERS" ON PAGE 2.
2. PAGES 4 THROUGH 8 SHOW METHODS OF LOADING ONE THROUGH EIGHT CONTAINERS. DUE TO THE SIZE OF THE CONTAINERS, EIGHT CONTAINERS IS THE MAXIMUM QUANTITY THAT CAN BE LOADED ON A TRAILER. BY USING THE METHODS SHOWN ON PAGES 4 THROUGH 8 AND THE "LOAD PLANNING GUIDANCE FOR ONE THROUGH EIGHT CONTAINERS" ON PAGE 2, LOADS OF ONE THROUGH EIGHT CONTAINERS MAY BE ACHIEVED. THESE METHODS ARE APPLICABLE FOR ANY TACTICAL VEHICLE HAVING A SUFFICIENT QUANTITY OF TIEDOWN FITTINGS LOCATED ON THE SIDEWALL OR ON THE FLOOR.
3. THE BEST METHOD OR COMBINATION OF METHODS SHOULD BE SELECTED FOR THE VEHICLE BEING LOADED. THE METHOD USED WILL DEPEND ON THE QUANTITY OF CONTAINERS TO BE LOADED AND THE TYPE OF VEHICLE USED. ANY COMBINATION OF THE LOADS SHOWN ON PAGES 4 THROUGH 8 MAY BE USED WHEN LOADING A VEHICLE.

TYPICAL TACTICAL VEHICLES AND MAXIMUM LOAD PER VEHICLE (SEE "NOTE ②" BELOW)		
TYPICAL TACTICAL VEHICLE AND/OR TRAILER BEING LOADED (SEE "NOTE ②" BELOW)	MAX NUMBER OF CONTAINERS IN LOAD, PER VEHICLE OR ACROSS WEIGHT LIMIT, OR SIZE OF VEHICLE	SEE THE LOAD OR COMBINATION OF LOADS SHOWN PAGE 1-8)
TRUCK, CARGO, 2-1/2 TON, 48 AND 433C	ONE CONTAINER (WEIGHT LIMIT)	PAGE 4
TRUCK, CARGO, 2 TON, 434	TWO CONTAINERS (WEIGHT LIMIT)	PAGE 6
TRUCK, CARGO, 3 TON, 433	TWO CONTAINERS (WEIGHT LIMIT)	PAGE 6
TRUCK, CARGO, 4 TON, 4520	TWO CONTAINERS (LIMITED TO VEHICLE SIZE)	PAGE 5
TRUCK, HEAVY EXPANDED MOBILITY, 10 TON, M977/ M983	FOUR CONTAINERS (WEIGHT LIMIT)	PAGE 3
TRAILER, CARGO, 11 TON	FOUR CONTAINERS (WEIGHT LIMIT)	PAGE 8
SEMITRAILER, STAKE, 12 TON, M127	FIVE CONTAINERS (WEIGHT LIMIT)	PAGE 4 AND PAGE 8 OR PAGE 6 AND PAGE 7
SEMITRAILER, 22-1/2 TON, M671	EIGHT CONTAINERS (WEIGHT LIMIT)	PAGE 8
SEMITRAILER, 34 TON, M672	EIGHT CONTAINERS (LIMITED TO VEHICLE SIZE)	PAGE 8

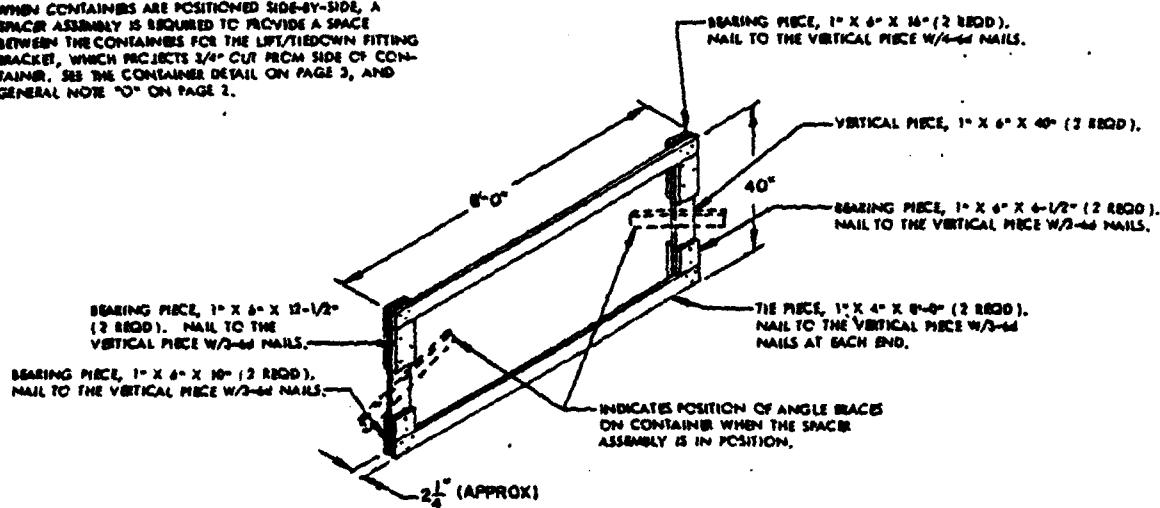
NOTE ②:

THE TACTICAL VEHICLES LISTED IN THE CHART ABOVE AND/OR AS SHOWN WITHIN THIS DRAWING WERE SELECTED AS TYPICAL ONLY. OTHER TYPES OF VEHICLES MAY BE USED IN LIEU OF THOSE SHOWN, AS LONG AS THEY COMPLY WITH GENERAL NOTE "C" ON PAGE 2. SEE THE "LOAD PLANNING GUIDANCE FOR ONE THROUGH EIGHT CONTAINERS" CHART ON PAGE 2, SPECIAL LOADING AND TIEDOWN PROCEDURES COVERING 1 THRU 4 U/C UNITS ON THE M977 10 TON HEAVY EXPANDED MOBILITY TACTICAL TRUCK AND ON THE M983 11 TON HEAVY EXPANDED MOBILITY AMMUNITION TRAILER ARE SPECIFIED ON PAGES 11 THRU 22. NOTE THAT IF THE M977 AND M983 VEHICLES ARE NOT EQUIPPED WITH A SPECIAL "CARGO TIEDOWN KIT", THE LOADING AND TIEDOWN PROCEDURES SPECIFIED ON PAGES 1 THRU 9 WILL BE USED TO SECURE 1 THRU 4 U/C UNITS ON THESE VEHICLES.



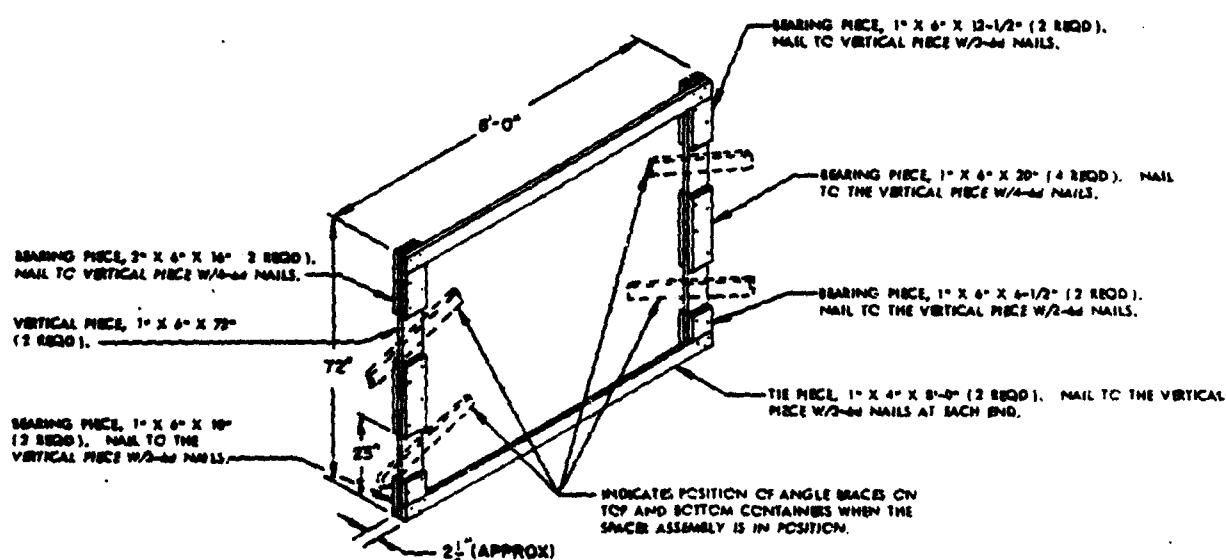
**NOTE ①:**

WHEN CONTAINERS ARE POSITIONED SIDE-BY-SIDE, A SPACER ASSEMBLY IS REQUIRED TO PROVIDE A SPACE BETWEEN THE CONTAINERS FOR THE LIFT/TIEDOWN FITTING BRACKETS, WHICH PROJECTS 3/4" OUT FROM SIDE OF CONTAINER. SEE THE CONTAINER DETAIL ON PAGE 3, AND GENERAL NOTE "D" ON PAGE 2.



**SPACER ASSEMBLY A**

THIS ASSEMBLY IS FOR USE BETWEEN ONE CONTAINER HIGH LOADS. WHEN FABRICATING THIS ASSEMBLY FIELD CHECK DIMENSIONS TO ASSURE THAT THE ANGLE BRACES ON THE CONTAINERS WILL FIT AS SHOWN ABOVE AND THE BEARING PIECES ON THE SPACER ASSEMBLY WILL CONTACT THE LOWER AND UPPER RAILS ON THE CONTAINER. SEE THE DETAIL ON PAGE 3 AND "NOTE ①" ON THIS PAGE.



**SPACER ASSEMBLY B**

THIS ASSEMBLY IS FOR USE BETWEEN TWO CONTAINERS HIGH LOADS. WHEN FABRICATING THIS ASSEMBLY FIELD CHECK DIMENSIONS TO ASSURE THAT THE ANGLE BRACES ON THE CONTAINERS WILL FIT AS SHOWN ABOVE AND THE BEARING PIECES ON THE SPACER ASSEMBLY WILL CONTACT THE LOWER AND UPPER RAILS ON THE CONTAINER. SEE THE CONTAINER DETAIL ON PAGE 3 AND "NOTE ①" ON THIS PAGE.

# PROPOSED LOADING AND BRACING PROCEDURES FOR ATACMS ROCKET POD/CONTAINERS ON COMMERCIAL FLATRACK CONTAINER

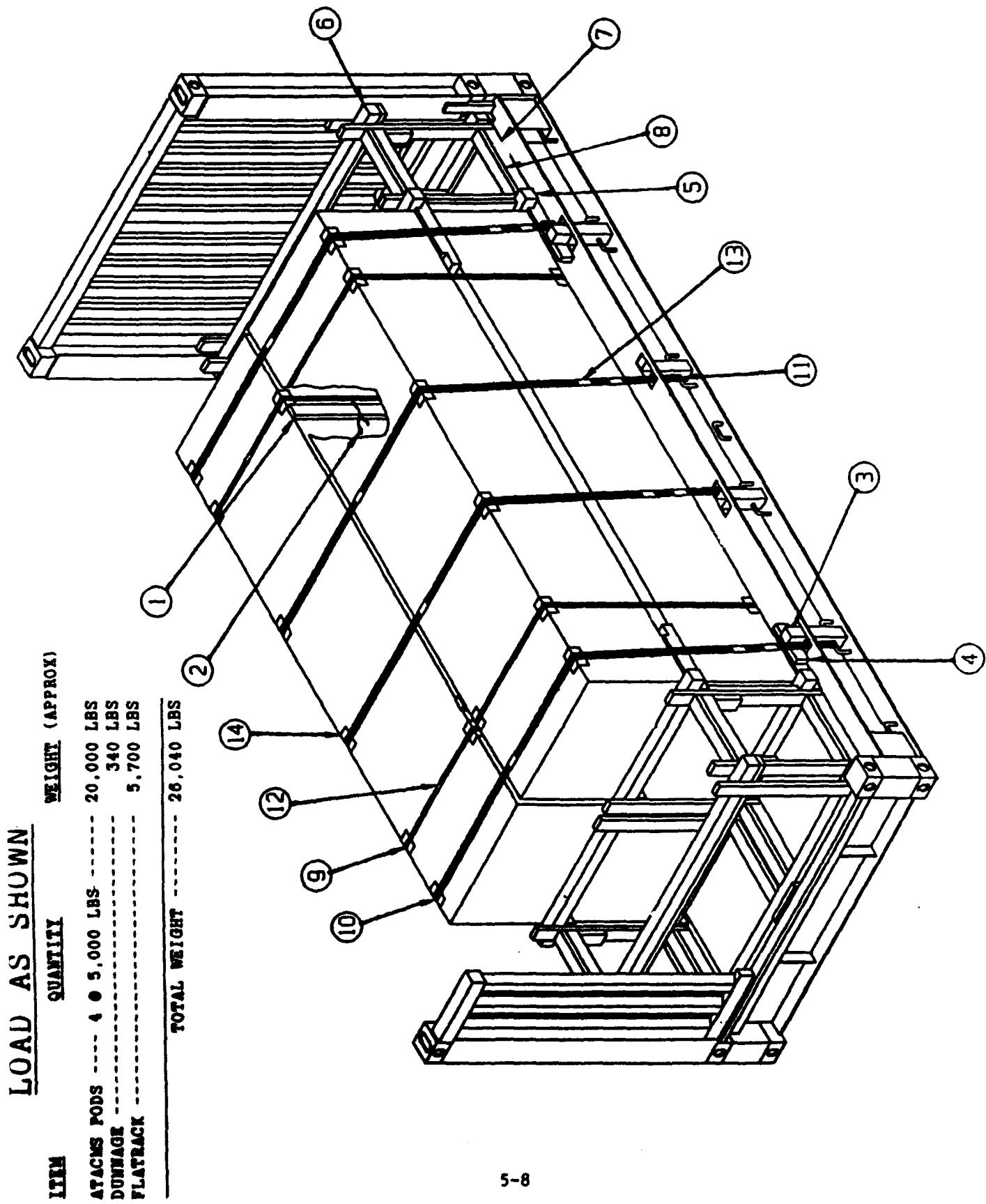
## INDEX

<u>ITEM</u>	<u>PAGE (S)</u>
ISOMETRIC OF FULL LOAD PROCEDURES -----	2
DESCRIPTION OF KEY NUMBERS -----	3
GATE DETAILS -----	4-5

NOTE: This 5 page document delineates proposed outloading procedures to be used for the shipment of ATACMS Rocket Pod/Containers when loaded on Commercial Flatrack Container. The procedures as delineated are to be verified by rail impact, road transportability, and shipboard simulation tests prior to their approval for actual shipment.

Prepared during July 1989 by:

U.S. Army Defense Ammunition  
Center and School  
ATTN: SMCAC-DEO  
Savanna, IL 61074-9639



- 1 CENTER FILL PIECE, 2" X 4" X 62-1/2" (2 REQD). POSITION A CENTER FILL PIECE APPROXIMATELY 34" FROM EACH END OF THE LOAD AS SHOWN.
- 2 TIE WIRE, NO. 14 GAGE, 24" LONG (4 REQD). FASTEN EACH CENTER FILL PIECE, PIECE MARKED 1, TO ONE STACK OF PODS AT TWO LOCATIONS BY LOOPING WIRE AROUND FRAME OF POD, BRINGING ENDS TOGETHER, AND TWISTING TAUT.
- 3 STAKE, 4" X 4" X 15" (4 REQD). INSTALL THE STAKES INTO THE FLATRACK STAKE POCKETS WITH A TIGHT (SNUG) FIT. NOTE: REFERENCE DIMENSIONS FOR A TIGHT FITTING STAKE ARE 3-1/4" (ACTUAL) X 3-1/4" (ACTUAL). TOENAIL TO THE FILLER PIECE, PIECE MARKED 4, W/2-10d NAILS ON EACH SIDE OF THE STAKE. NAIL 1-20d NAIL THROUGH THE HOLE PROVIDED IN THE FACE OF THE FLATRACK STAKE POCKET AND INTO THE STAKE. BEND THE PROTRUDING HEAD OF THE NAIL OVER AGAINST THE STAKE POCKET.
- 4 FILLER PIECE, 2" X 4" X 12" (4 REQD). CENTER ON FACE OF THE STAKE, PIECE MARKED 3, AS SHOWN.
- 5 LOAD BEARING GATE (2 REQD). SEE THE "LOAD BEARING GATE" DETAIL. CENTER ASSEMBLY AGAINST END OF LOAD.
- 6 END WALL GATE (2 REQD). SEE THE "END WALL GATE DETAIL". POSITION AS SHOWN SO THE RETAINER PIECES ARE LOCATED ON THE INSIDE EDGES OF THE CORNER POSTS. NOTE: NAIL A 1" X 4" X 5" SHIM TO FACE OF EACH END OF THE LOWER BEAM ASSEMBLY TO PROVIDE A UNIFORM FIT OF THE GATE AGAINST THE CORNER POSTS.
- 7 STRUT "A", 4" X 4" BY CUT-TO-FIT (REF: 22") (12 REQD). INSTALL AS SHOWN AND TOENAIL EACH END TO THE GATE W/2-12d NAILS.
- 8 STRUT "B", 2" X 4" BY CUT-TO-FIT (REF: 22") (12 REQD). LAMINATE TO STRUT "A", PIECE MARKED 7, W/4-10d NAILS.
- 9 STACK UNITIZING STRAP, 1-1/4" X .035" OR .031" BY A LENGTH-TO-SUIT (REF: 19'-0") (4 REQD). INSTALL EACH UNITIZING STRAP TO ENCIRCLE A STACK OF PODS AS SHOWN ABOVE.
- 10 HOLD-DOWN STRAP, 2" X .044 OR .050" BY A LENGTH-TO-SUIT (REF: 26'-0") (4 REQD). INSTALL EACH STRAP FROM TWO 13'-0" LONG PIECES FASTENED TO THE TIEDOWN PROVISIONS ON THE SIDES OF THE FLATRACK AND ON TOP OF THE LOAD AS SHOWN ABOVE.
- 11 PAD, STRAPPING, 2" X .044" OR .050 X 18" (8 REQD). PRE-POSITION THE PAD BETWEEN THE HOLD-DOWN STRAP, PIECE MARKED 10, AND THE FLATRACK TIEDOWN PROVISION AND SECURE WITH ONE SEAL CRIMPED WITH ONE PAIR OF NOTCHES.
- 12 SEAL FOR 1-1/4" STRAPPING (4 REQD, 1 PER STRAP). FASTEN EACH STACK UNITIZING STRAP, PIECE MARKED 9, WITH ONE SEAL, CRIMPED WITH TWO PAIR OF NOTCHES.
- 13 SEAL FOR 2" STRAPPING (20 REQD, 5 PER STRAP). FASTEN EACH HOLD-DOWN STRAP, PIECE MARKED 10, AT THREE LOCATIONS (SIDES AND TOP) WITH ONE SEAL CRIMPED WITH TWO PAIR OF NOTCHES AT EACH LOCATION. FASTEN EACH STRAPPING PAD, PIECE MARKED 11, WITH ONE SEAL CRIMPED WITH ONE PAIR OF NOTCHES. SEE GENERAL NOTE "K" ON PAGE 2.
- 14 EDGE PROTECTOR, FOLDED FIBERBOARD (AS REQD). POSITION UNDER THE STACK UNITIZING STRAPS, PIECES MARKED 9, AND UNDER THE HOLD-DOWN STRAPS, PIECES MARKED 10, AT POINTS OF CONTACT WITH EDGES OF THE POD'S FRAME.

ACMS ON FLAT RACK

Horizontal beam, 4x4x90" (2 legs).

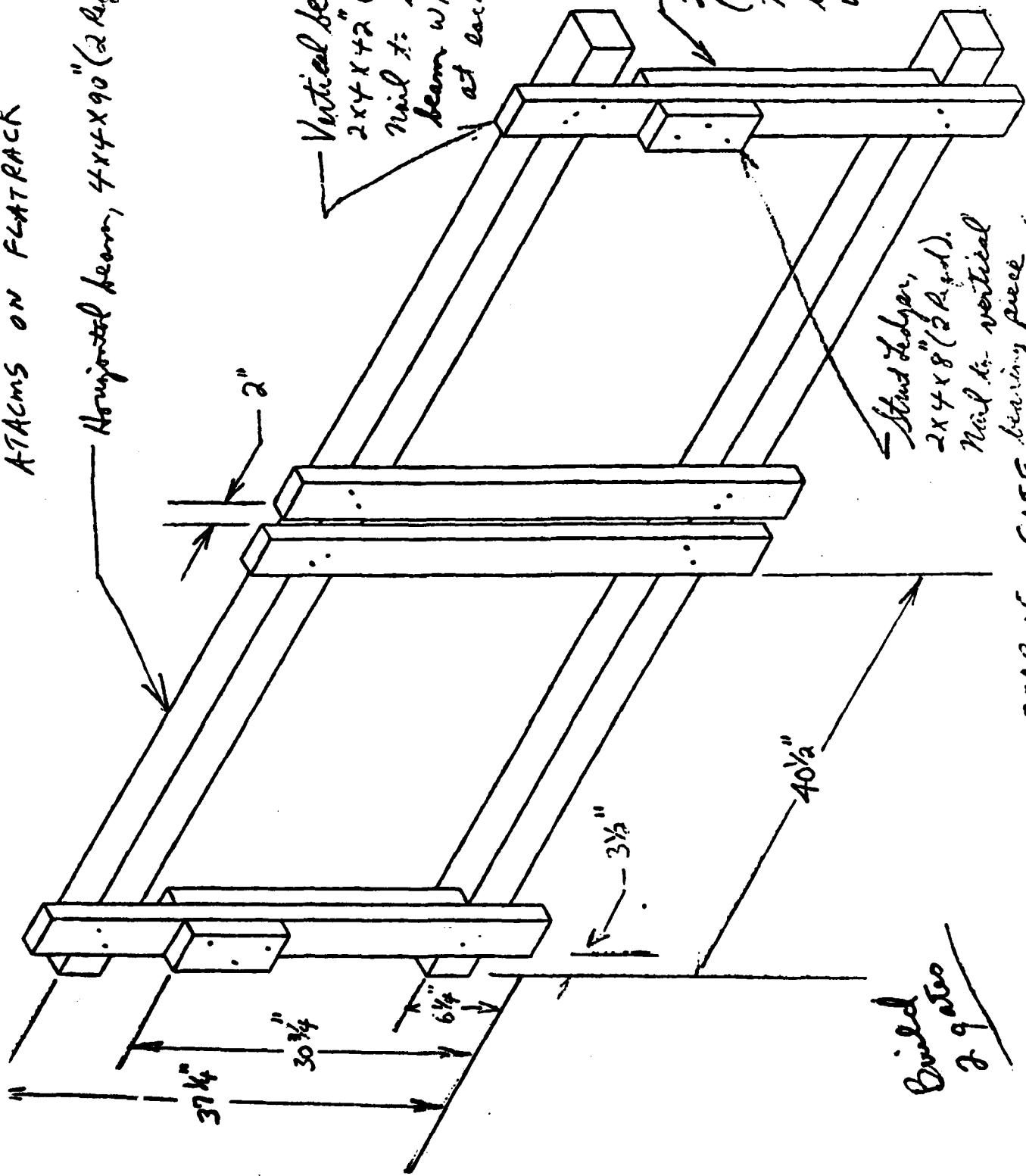
Vertical bearing piece,  
2x4x42" (4 legs).  
Nail to horizontal  
beam w/2-10d nails  
at each joint.

Vertical Drivin,  
2x4x34 1/2  
(2 legs).  
Nail to each w/  
bearing piece  
w/4-10d nails.

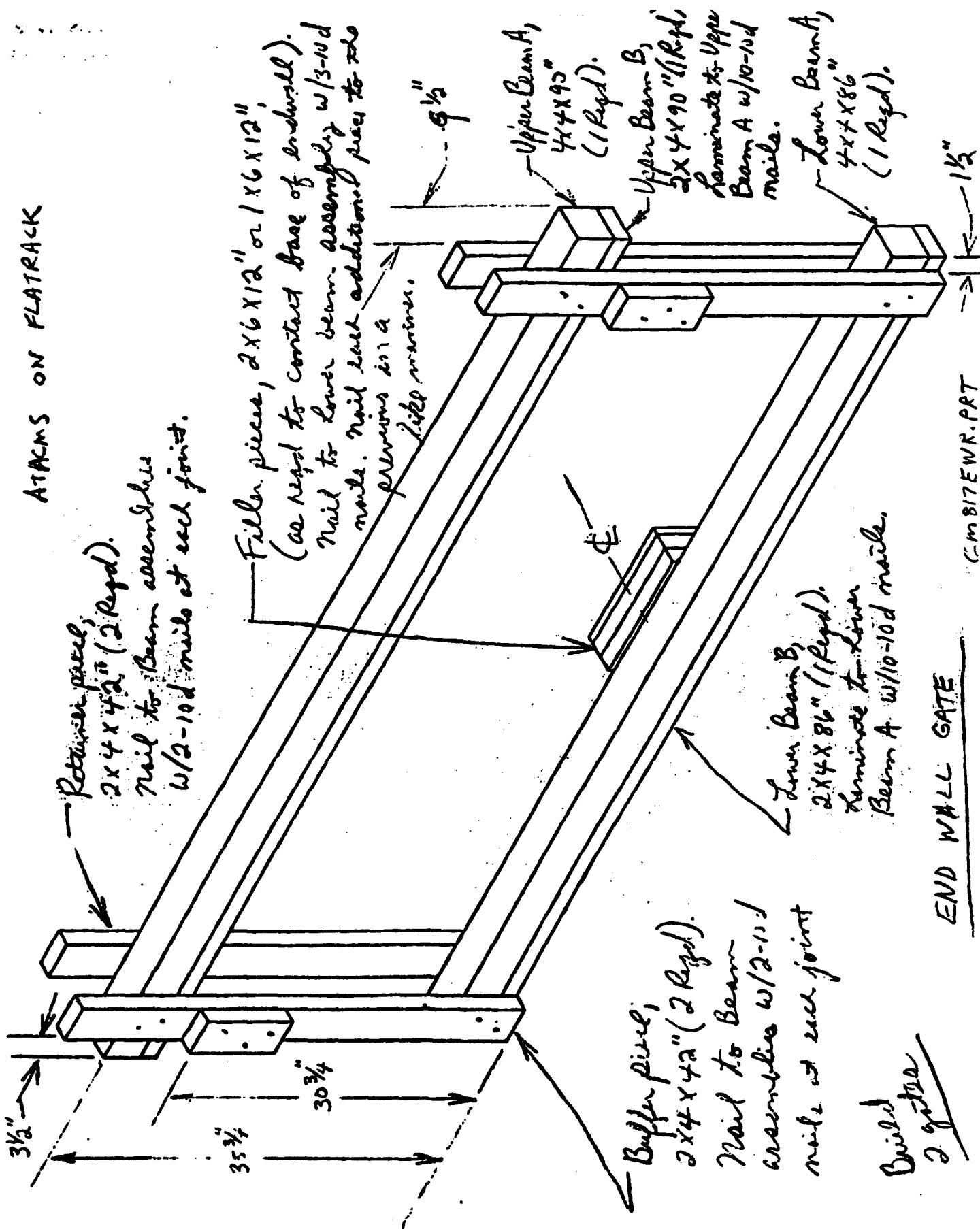
Stand holder,  
2x4x8" (2 legs).  
Nail to vertical  
bearing piece  
w/3-10d nails.

LOAD BEARING GATE

Vertical  
8x90



ARMS ON FLATRACK



APPROVED BY  
U.S. COAST GUARD  
*R. L. Johnson*  
DATE 01/15/87

APPROVED BY  
MACROCOSM MATERIALS SYSTEMS  
RECEI: ASSOCIATION OF AMERICAN  
RAILROADS  
DATE \_\_\_\_\_

## MLRS

# LOADING AND BRACING WITH LOAD AND ROLL PLATFORM IN COMMERCIAL CONTAINERS OF ROCKET POD/ CONTAINERS (RP/C) FOR MULTIPLE LAUNCH ROCKET SYSTEM, FOR SHIPMENT BY T/COFC CARRIER

- THE LOAD AND ROLL PLATFORM IS A COMMERCIAL PRODUCT. FOR A SOURCE OF SUPPLY, CONTACT CONTAINER CONCEPTS, INC., 1521 BICKERSTAFF DRIVE, BONNERS GROVE, IL 60516. PHONE 1-312-966-1235.
- LOADING AND BRACING SPECIFICATIONS SET FORTH WITHIN THIS DRAWING ARE APPLICABLE TO LOADS THAT ARE TO BE SHIPPED BY TRAILER/CONTAINER-ON-FLAT-CAR (T/COFC) RAIL CARRIER SERVICE. THESE SPECIFICATIONS MAY ALSO BE USED FOR LOADS THAT ARE TO BE MOVED BY MOTOR OR WATER CARRIERS. SEE GENERAL NOTE "L" ON PAGE 2.

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### GENERAL NOTES

1. THIS DOCUMENT HAS BEEN PREPARED AND ISSUED IN ACCORDANCE WITH AR 700-1 AND ALIGNMENTS IN 703-200-1 (CHAPTER 3).

2. THIS DOCUMENT HAS BEEN PREPARED AND ISSUED TO SUPPORT A TELLSHIPMENT PROGRAM. THE UNLOADING PROCEDURES DEPICTED HEREIN ARE APPLICABLE TO THE MULTIPLE LAUNCH ROCKET SYSTEM (MLRS) POD/CONTAINER AND TO TELLSHIPMENT REFERRED TO CONTAINERS HEREIN MEANS THE MLRS WITH ROCKET COMPONENTS.

3. FOR DETAILS OF THE ROCKET POD CONTAINER, SEE LR ARMY MISSILE COMMAND DRAWING NO. 13027908.

CONTAINER DIMENSIONS ---- 13'-0" LONG BY 61-1/2" WIDE BY 39" HIGH

GROSS WEIGHT ----- 3,228 POUNDS APPROX.

4. THIS ITEM IS A DOD CLASS "A" EXPLOSIVE, AND A COAST GUARD CLASS II-C. THE CURLADING PROCEDURES SPECIFIED HEREIN CAN ALSO BE UTILIZED FOR THE SHIPMENT OF THE DEPICTED CONTAINERS WHEN THEY ARE LOADED WITH AN ITEM WHICH IS SHIPPIED DIFFERENTLY BY NOMENCLATURE THAN THE ITEM DESIGNATED IN THE DRAWING TITLE.

5. THE LOAD AS SHOWN IS BASED ON A 4,700 POUND 20'-0" LONG BY 8'-0" WIDE BY 8'-0" HIGH INTERMODAL COMMERCIAL CONTAINER WITH INSIDE DIMENSIONS OF 19'-4" LONG BY 78" WIDE BY 95" HIGH. THE LOAD IS DESIGNED FOR TRAILER/CONTAINER-ON-LATCAR (T/COFC) SHIPMENT; HOWEVER, THE LOAD AS DESIGNED CAN ALSO BE MOVED BY OTHER SURFACE MODES OF TRANSPORT. NOTICE: OTHER CONTAINERS OF THE SAME DESIGN CONFIGURATION CAN BE USED.

6. WHEN LOADING THE CONTAINERS, THEY ARE TO BE POSITIONED SO AS TO ACHIEVE TIGHT LOAD (TIGHT AGAINST THE FORWARD BLOCKING ASSEMBLY). ALTHOUGH A TOTAL OF ONE AND ONE-HALF INCHES OF UNLOCKED SPACE ACROSS THE WIDTH OF THE LOAD BAY IS PERMITTED, LATERAL Voids WITHIN THE LOAD ARE TO BE HELD TO A MINIMUM. EXCESSIVE SLACK CAN BE ELIMINATED FROM A LOAD BY LAMINATING ADDITIONAL PIECES OF APPROPRIATE THICKNESS TO THE FIL PIECES OR THE FIL PIECE W/H APPROPRIATELY SIZED NAILS. ADDITIONALLY, THE THICKNESS OF THE FIL PIECES MAY BE ADJUSTED AS REQUIRED TO FACILITATE VARIANCE IN THE LENGTH OF THE LOAD AND ROLL PLATE ORN.

7. DUNNAGE LUMBER SPECIFIED IS OF NOMINAL SIZE. FOR EXAMPLE, 1-1/2" MATERIAL IS ACTUALLY 3/4" INCH BY 5-1/2" WIDE AND 2-1/2" MATERIAL IS ACTUALLY 1-1/2" BY 3-1/2" WIDE.

8. WHEN STEEL STRAPPING IS SEALED AT AN END-OVER-END LAP JOINT, A MINIMUM OF ONE SEAL WITH TWO PAIR OF NOTCHES WILL BE USED. A MINIMUM OF TWO SEALS, BUTTED TOGETHER, WITH TWO PAIR OF CRIMPS PER SEAL WILL BE USED TO SEAL THE JOINT WHEN A CRIMP TYPE SEALER IS BEING USED. REFER TO THE "STRAP JOINT A" AND "STRAP JOINT B" DETAILS ON PAGE 3 FOR GUIDANCE.

9. PORTIONS OF THE CONTAINER DEPICTED WITHIN THIS DRAWING, SUCH AS ONE OF THE SIDE WALLS, HAVE NOT BEEN SHOWN IN THE LOAD VIEW FOR CLARITY PURPOSES.

10. DIMENSIONS GIVEN FOR DUNNAGE PIECES OR ASSEMBLIES WILL BE FIELD CHECKED PRIOR TO THEIR ASSEMBLY AND INSTALLATION IN THE COMMERCIAL CONTAINERS.

11. REQUIREMENTS CITED WITHIN THE BUREAU OF EXPLOSIVES PAMPHLET 4C APPLY WHEN THE SHIPMENT MOVES BY TRAILER/CONTAINER-ON-LATCAR (T/COFC). SPECIAL TCOFC NOTES FOLLOW:

1. A LOADED CONTAINER MUST BE ON A CHASSIS EQUIPPED WITH TWO BOGIE ASSEMBLIES WHEN BEING MOVED IN TELLSERVICE.
2. THE LOAD LIMIT OF A T/COFC BALKAS MUST NOT BE EXCEEDED, NOR WILL A CAR BE LOADED SO THAT THE TRUCK UNDER ONE END OF THE CAR CARRIES MORE THAN ONE-HALF OF THE LOAD LIMIT FOR THAT CAR.

(CONTINUED AT RIGHT)

### GENERAL NOTES (CONTINUED)

12. DURING INTRASTATE AND/OR INTERSTATE MOVES BY MOTOR CARRIER, A PROPER CHASSIS/MOTORHOME FLATBED TRAILER MUST BE USED TO PRECLUDE VIOLATION OF ONE OR MORE "WEIGHT LAWS" APPLICABLE TO THE STATE OR STATES INVOLVED.

13. CONVERSION TO METRIC EQUIVALENTS: DIMENSIONS WITHIN THIS DOCUMENT ARE EXPRESSED IN INCHES AND WEIGHTS ARE EXPRESSED IN POUNDS. WHEN NECESSARY, THE METRIC EQUIVALENTS MAY BE COMPUTED ON THE BASIS OF ONE INCH EQUALS 25.4MM AND ONE POUND EQUALS 0.454KG.

### MATERIAL SPECIFICATIONS

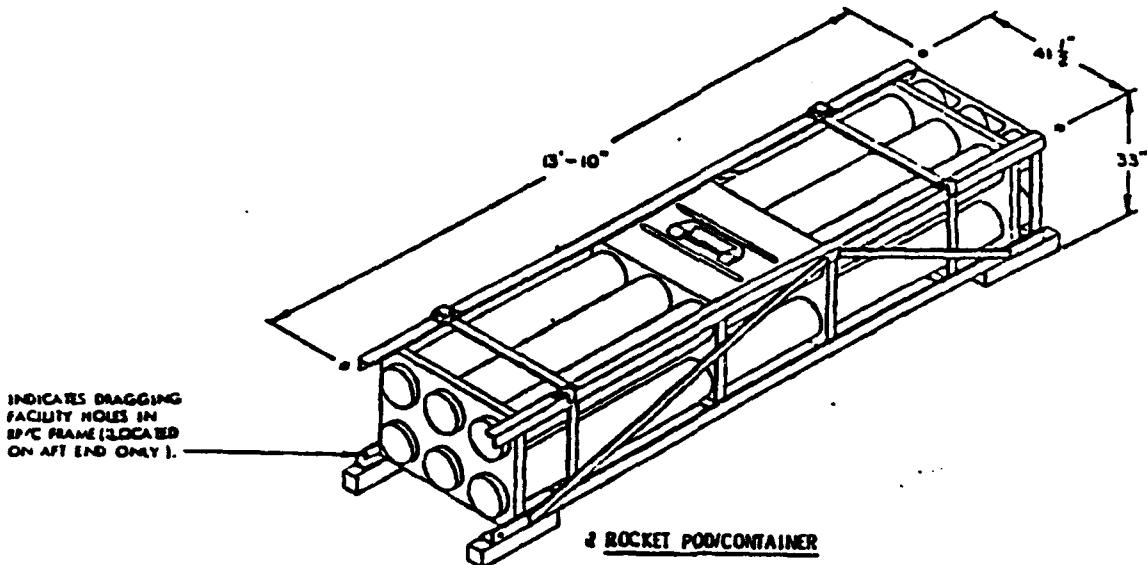
14. 100 703-200-1 (DUNNAGE LUMBER) AND PTD SPEC 100-1-931.

15. PTD SPEC PT-10-100, COMMON.

16. PTD SPEC QC-11-401.

17. AND PTD PLATFORM - 100-1070-100-1, PATENT PENDING PLATE.

18. TRAILER MASTERS PTD SPEC PTD-5-320, TYPE 52 SOLID PINE RAILING.



### SPECIAL HANDLING GUIDANCE

#### 1. CONTAINER STACKING FOR UNLOADING PURPOSES.

- A. THE UPPER CONTAINER SHOULD BE PLACED AS CLOSELY AS POSSIBLE IN VERTICAL ALIGNMENT WITH THE LOWER CONTAINERS.
- B. WHEN STACKING THESE CONTAINERS, CARE MUST BE EXERCISED TO INSURE THAT THE INTERLOCKING HOLES IN THE BOTTOM OF THE CONTAINERS SKIDS ALIGN CORRECTLY WITH THE INTERLOCKING PINS ON THE TOP OF THE CONTAINER FRAME. THIS WILL PRECLUDE DAMAGE TO THE SKIDS AND INSURE PROPER FUNCTIONING OF THE CONTAINER INTERLOCKS.

#### 2. CONTAINERS OR CONTAINER STACK HANDLING.

NOTES: (1) MATERIALS HANDLING EQUIPMENT (MHE) IS INTENDED TO MEAN EQUIPMENT, SUCH AS FORKLIFT TRUCKS, CRANES, HAND TRUCKS, BOLLES, ROLLER ASSEMBLIES, SLINGS, AND SPREADER BARS, THAT CAN BE USED TO HANDLE THE DEPICTED CONTAINERS.

(2) PRECAUTIONARY HANDLING TECHNIQUES NORMALLY EMPLOYED OR AS SPECIFIED FOR THE TYPE OF COMMODITY INVOLVED WILL BE OBSERVED.

- A. ONLY APPROVED AND APPROPRIATELY SIZED MHE WILL BE USED FOR HANDLING THE DEPICTED CONTAINERS.
- B. IF HANDLING IS ACCOMPLISHED WITH A FORKLIFT TRUCK, THE CONTAINERS SHOULD BE HANDLED FROM A SIDE POSITION ONLY. CARE MUST BE EXERCISED WHEN INSERTING THE FORKS UNDER THE CONTAINER TO PREVENT DAMAGE TO THE CONTAINER BY THE FORK TIRES OR THE FORKLIFT PACKAGE GUARD. ADDITIONALLY, THE FORK TIRES SHOULD BE PLACED UNDER THE CONTAINER'S STRONGEST AREAS, THAT IS, THE LATERAL FRAME MEMBERS/BUSHHEADS LOCATED NEAR THE LONGITUDINAL CENTER OF THE CONTAINER.

#### 3. UNLOADING CONTAINER STACKING.

- A. NOTE: FOR EASY IN LOADING THE LOAD AND ROLL PLATFORM INTO THE COMMERCIAL CONTAINER, SET THE FORWARD END OF THE LOAD AND ROLL PLATFORM IN THE OPEN END OF THE COMMERCIAL CONTAINER AND INSTALL APPROPRIATELY SIZED 4" BY PLATFORM WIDTH MATERIAL UNDER THE REAR OF THE LOAD AND ROLL PLATFORM UNTIL THE PLATFORM IS LEVEL HORIZONTALLY.

- B. LOAD THE CONTAINERS OR CONTAINER STACKS BY FIRST INSERTING THE FAR SKIDS IN THE CENTER SKID HOLDERS ON THE LOAD AND ROLL PLATFORM, THEN LOWERING AND INSERTING THE NEAR SKIDS INTO THE OUTSIDE SKID HOLDERS ON THE PLATFORM. NOTE: THE AFT END OF THE CONTAINERS MUST BE POSITIONED AT THE FORWARD END OF LOAD AND ROLL PLATFORM.

- C. APPLY THE STACK UNITIZING STRAP. NOTE: FIBERBOARD ANTI-CHAFING MATERIAL MUST BE INSTALLED UNDER THE STRAPS AT ALL POINTS OF CONTACT WITH THE CONTAINERS.

#### (SPECIAL HANDLING GUIDANCE CONTINUED)

INSTALL THE CENTER FILL PIECES. POSITION THE CENTER FILL PIECES SO THAT THEY ARE SUPPORTED BY THE TOP SIDE OF THE FORK POCKET (TUNNEL) ON THE LOAD AND ROLL PLATFORM. WIRE TIE THE CENTER FILL PIECES TO THE CONTAINER FRAME.

NEXT, LOAD AND UNPILE THE REMAINING CONTAINERS IN THE MANNER DETAILED IN PARAGRAPHS 3B AND 3C AT LEFT.

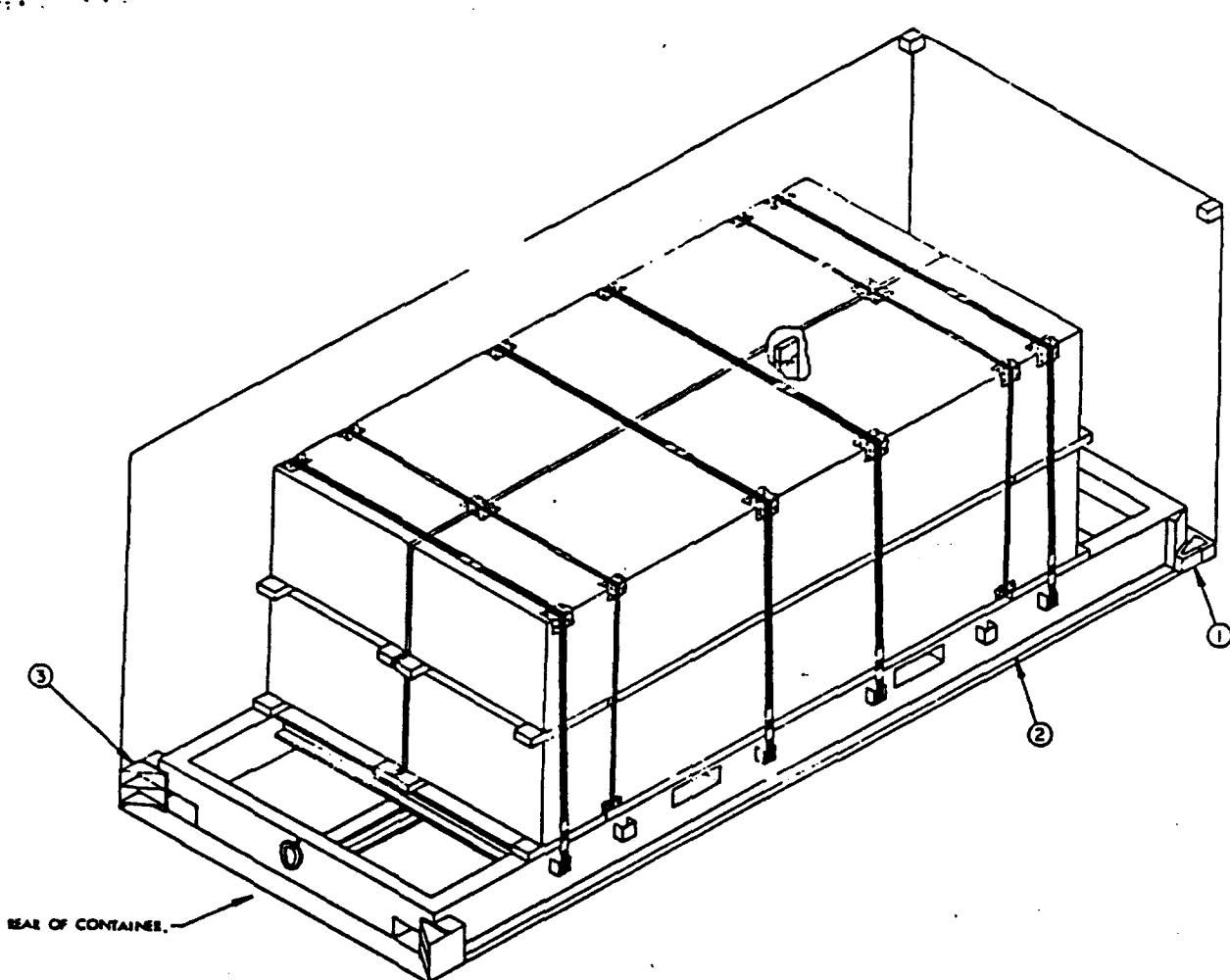
APPLY THE HOLD-DOWN STRAPS, POSITIONING FIBERBOARD ANTI-CHAFING MATERIAL UNDER THE STRAPS AT ALL POINTS OF CONTACT WITH THE CONTAINERS. CAUTION: THE HOLD-DOWN STRAPS MUST BE INSTALLED WITH CARE SO AS NOT TO HAVE EDGE-TO-EDGE CONTACT WITH THE STACK UNITIZING STRAPS.

G. POSITION THE FORWARD BLOCKING ASSEMBLY IN THE COMMERCIAL CONTAINER. LIFT THE REAR END OF THE LOAD AND ROLL PLATFORM WITH APPROPRIATELY SIZED MHE UNTIL ONLY THE ROLLER CONTACTS THE COMMERCIAL CONTAINER FLOOR (REF: 4"). ROLL THE PLATFORM INTO THE CONTAINER UNTIL IT CONTACTS THE FORWARD BLOCKING ASSEMBLY. SET THE REAR OF THE PLATFORM ON THE COMMERCIAL CONTAINER FLOOR. INSTALL THE CORNER RETAINERS PIECES AND FILL MATERIAL AS NECESSARY.

#### UNLOADING THE LOAD AND ROLL PLATFORM FROM THE COMMERCIAL CONTAINER.

- A. THE LOAD AND ROLL PLATFORM MAY BE UNLOADED USING THE REVERSE OF THE METHOD DETAILED IN 3C ABOVE.

- B. THE LOAD AND ROLL PLATFORM MAY ALSO BE UNLOADED USING A VEHICLE WITH AN APPROPRIATELY SIZED WINCH. FIRST, REMOVE THE CORNER RETAINERS PIECES. ATTACH THE WINCH TO THE D-RING ON THE REAR OF THE LOAD AND ROLL PLATFORM, BASE THE PLATFORM UNTIL THE ROLLER CONTACTS THE COMMERCIAL CONTAINER FLOOR, AND PULL THE PLATFORM TOWARD OUT OF THE COMMERCIAL CONTAINER. CARE NOT TO PULL THE PLATFORM TOWARD OUT OF THE COMMERCIAL CONTAINER. SET BLOCKING UNDER THE REAR END OF THE PLATFORM, AND UNLOAD THE MHE CONTAINERS, USING APPROPRIATELY SIZED MHE.



ISOMETRIC VIEW

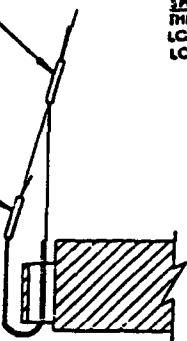
KEY NUMBERS

- ① FORWARD BLOCKING ASSEMBLY (1 REQD).
- ② LOAD AND ROLL PLATFORM, LOADED (1 REQD). SEE THE DETAIL ON PAGE 6.
- ③ CORNER RETAINER PIECE (2 REQD).

INDICATES A SEAL FOR THE HOLD-DOWN STRAPS.

**SPECIAL NOTE:**  
THE SEAL IS USED TO FASTEN THE HOLD-DOWN STRAPS TO LOAD AND ROLL PLATFORM TIEDOWN ANCHOR SHOULD BE LOCATED A MINIMUM OF 18° ABOVE THE PLATFORM DECK.

INDICATES A SEAL FOR THE PAD.



TIEDOWN DETAIL

ONE SEAL WITH  
TWO PAIR OF  
NOTCHES.



STRAP JOINT A

METHOD OF SECURING A STRAP JOINT WHEN USING A NOTCH-TYPE SEALER.

TWO SEALS, BUTTED  
TOGETHER, WITH  
TWO PAIR OF CRIMPS  
EACH SEAL.



STRAP JOINT B

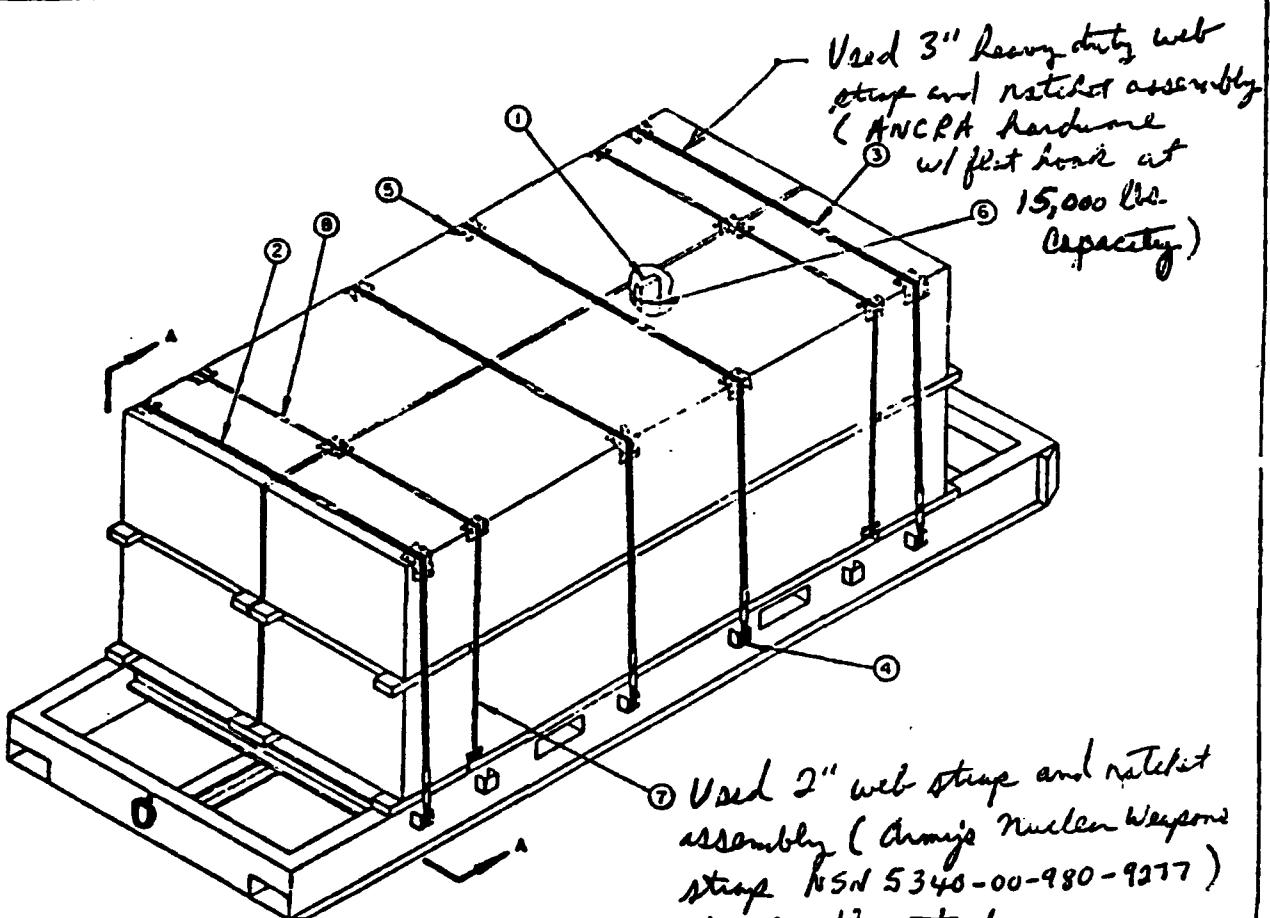
METHOD OF SECURING A STRAP JOINT WHEN USING A CRIMP-TYPE SEALER.

BILL OF MATERIAL

LUMBER	LINEAR FEET	BOARD FEET
2" X 6"	11	11
STEEL STRAPPING, 2" X .030"	128' RECD	43 LBS
SEAL, FOR 2" STRAPPING	24 RECD	5 LBS
STEEL STRAPPING, 1-1/4" X .035" OR .031"	89" RECD	12 LBS
SEAL FOR 1-1/4" STRAPPING	8 RECD	1/2 LBS
WIRE, NO. 14 GAGE	8" RECD	NIL
FIBERBOARD ANTI-CHAFING MATERIAL	45 RECD	NIL
LOAD AND ROLL PLATFORM	1 RECD	1,923 LBS

LOAD AS SHOWN

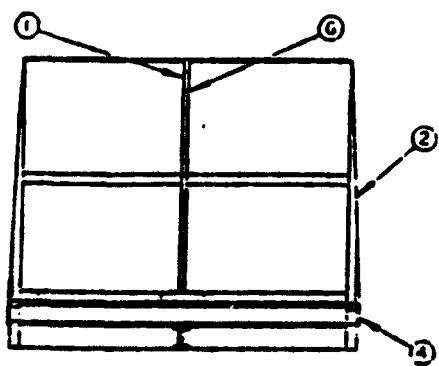
ITEM	QUANTITY	WEIGHT (APPROX.)
MILS SP/C	4	20,312 LBS
DUNNAGE	1	2,016 LBS
COMMERCIAL CONTAINERS	1	4,700 LBS
TOTAL WEIGHT		27,028 LBS



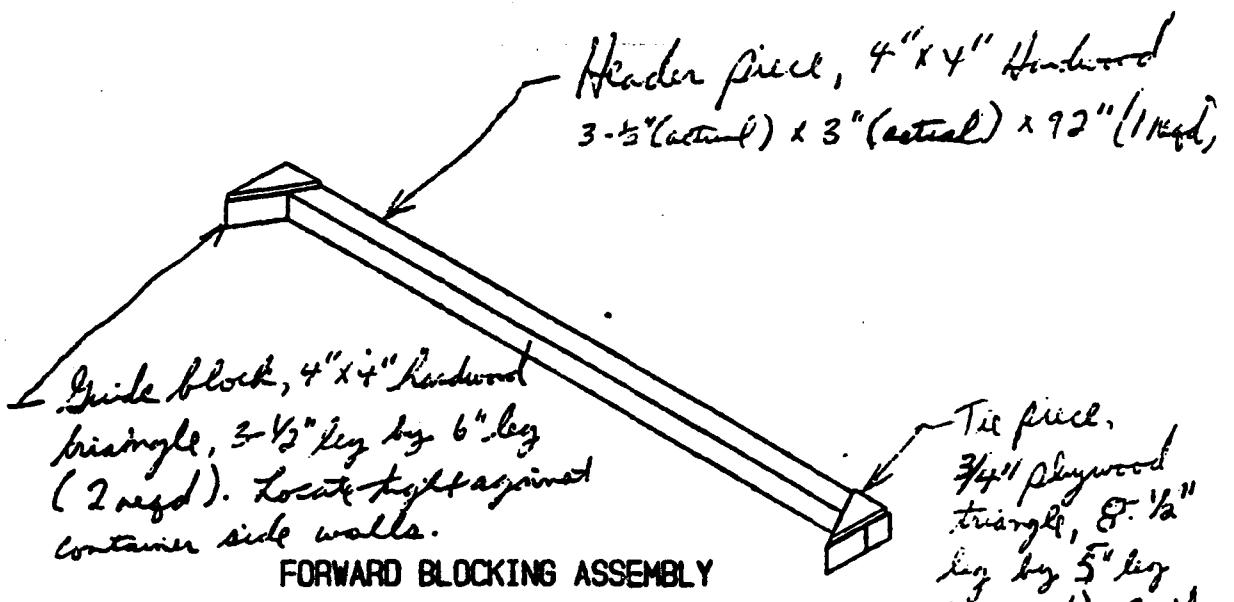
ISOMETRIC VIEW

KEY NUMBERS

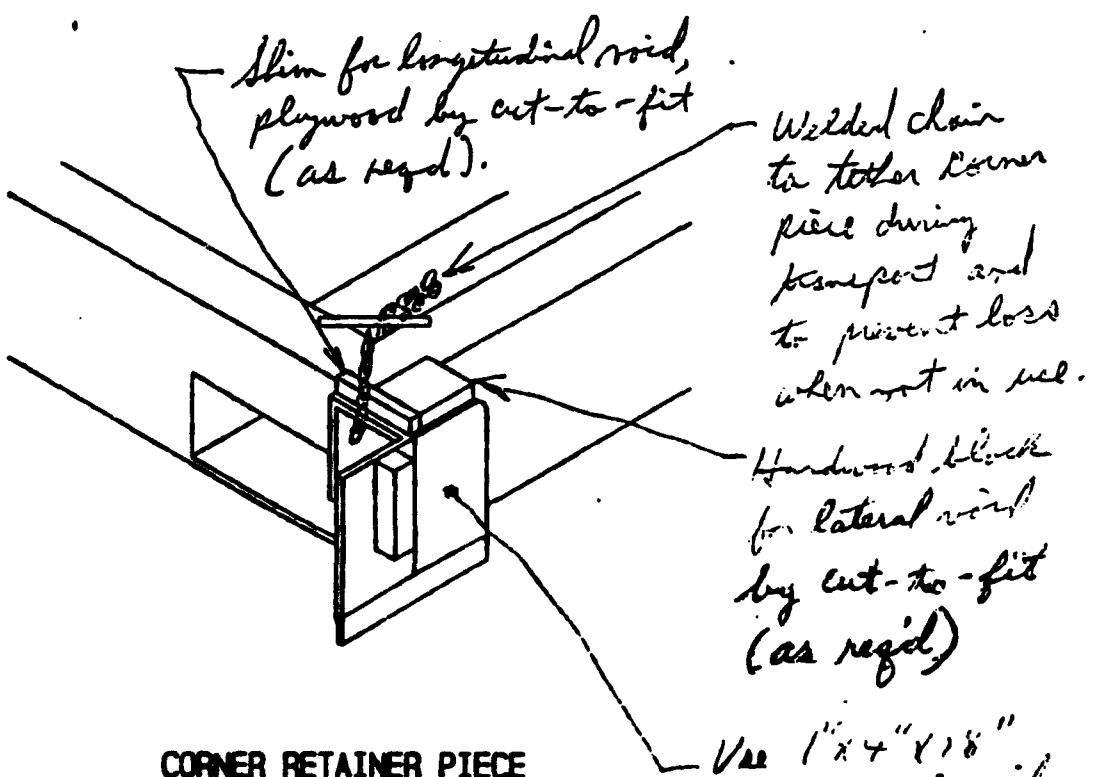
- ① CENTER FILL PIECE, 2" X 6" X 46" (2 RECD). POSITION ON THE FORKLIFT TUNNEL.
- ② HOLD-DOWN STRAP, 2" X .050" X 28'-0" LONG STEEL STRAPPING (4 RECD). INSTALL EACH STRAP FROM TWO 14'-0" LONG PIECES.
- ③ SEAL, 2" (24 RECD, 6 PER STRAP). DOUBLE CLAMP EACH SEAL, EXCEPT THOSE USED TO SECURE THE PADS, PIECES MARKED ④. SEE GENERAL NOTE "W" ON PAGE 2.
- ④ PAD, STRAPPING, 2" X .050" X 24" (8 RECD). PREPOSITION THE PAD BETWEEN THE STRAPPING, PIECE MARKED ②, AND THE LOAD AND ROLL PLATFORM HOLDDOWN PROVISION AND SECURE WITH ONE PAIR OF CLAMPS. SEE THE "HOLDDOWN" DETAIL ON PAGE 3.
- ⑤ FIBERBOARD ANTI-CHAFING MATERIAL (AS RECD). PLACE UNDER STRAPPING AT ALL POINTS OF CONTACT WITH THE CONTAINERS.
- ⑥ 18 WIRE, NO. 14 GAGE WIRE, 28" LONG (4 RECD). WIRE TO FORM A LOOP AROUND A HORIZONTAL FRAME MEMBER OF A CONTAINER AND THE CENTER FILL PIECE, PIECE MARKED ①. BRING ENDS TOGETHER AND TWIST TIGHT.
- ⑦ SEAGI LUMBER/PLATE STRAP, 1-1/8" X .050" (1.50" BY A 1.50" BY 1.50" SLAB) (REF: 20'-0") (4 RECD). INSTALL TO ENCLOSE THE CONTAINERS IN ONE STACK.
- ⑧ SEAL, 1-1/8" (8 RECD, 2 PER STRAP). CLAMP EACH SEAL WITH TWO PAIR OF CLAMPS. SEE GENERAL NOTE "W" ON PAGE 2.



SECTION A-A



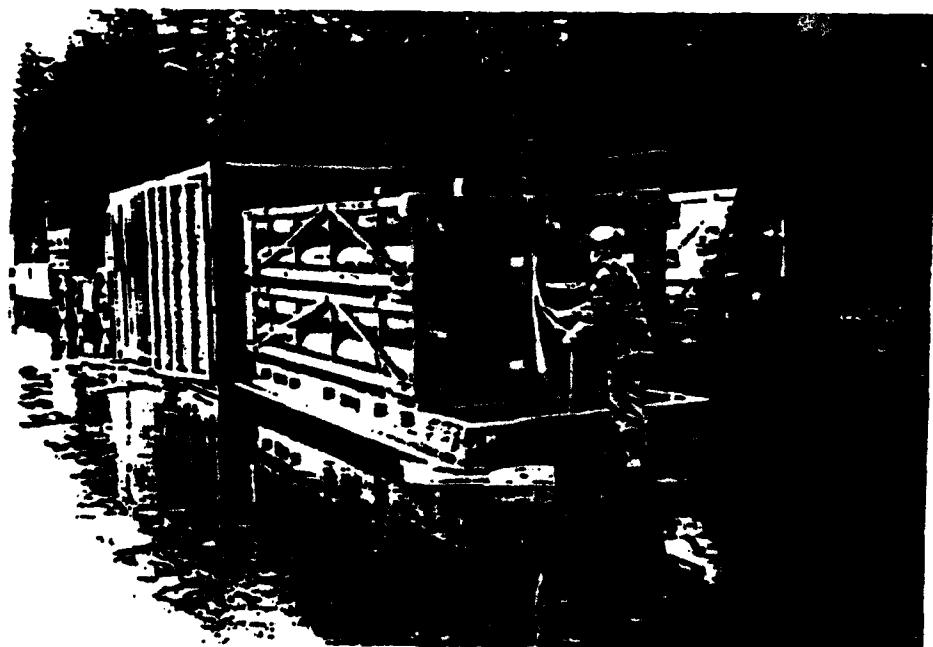
Tie piece,  
3/4" plywood  
triangle, 8-1/2"  
leg by 5" leg  
(2 reqd). Nail  
to guide block  
w/ 2-6d nails and  
to the header piece  
w/ 3-6d nails



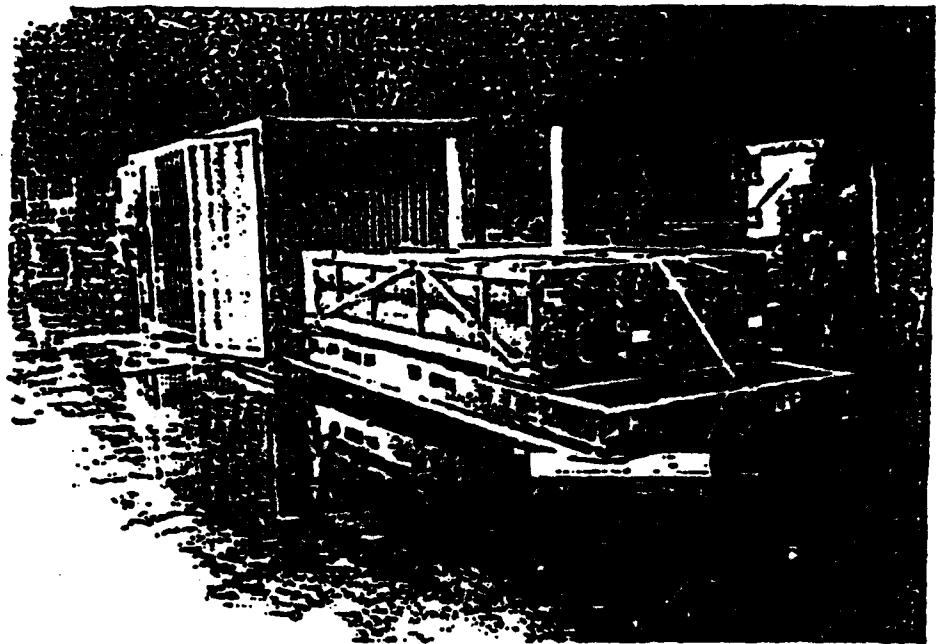
Use 1" x 4" x 18"  
piece to fill void  
between corner block  
and belt nail of  
MIL-VAN  
(wire tie to belt nail)



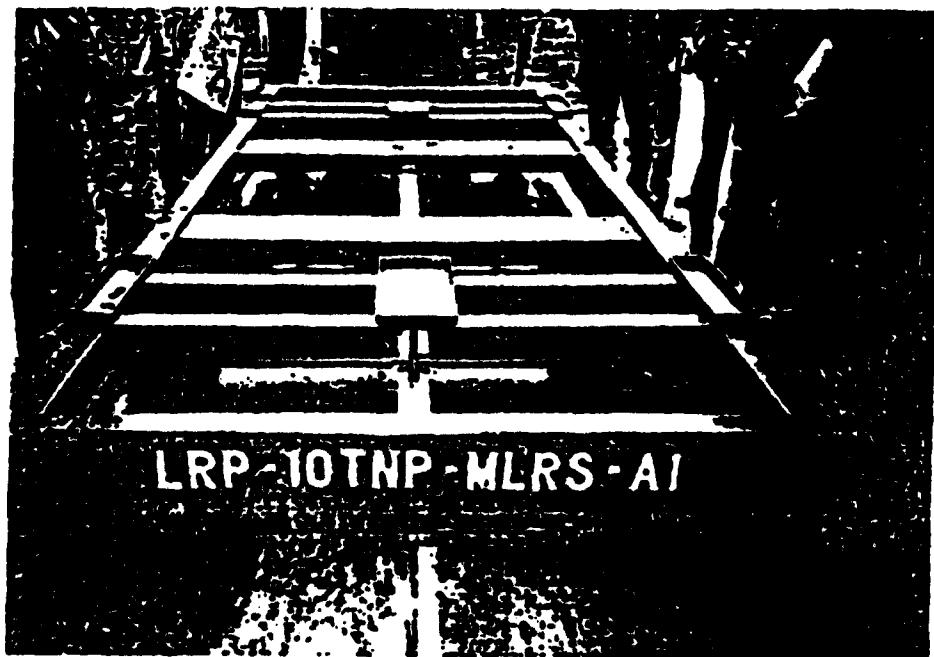
HLRS PODS SECURED ON LOAD AND ROLL PLATFORM (LRP)  
AND BLOCKED INSIDE STANDARD COMMERCIAL CONTAINER



AFTER REMOVING CORNER BLOCKS AND ROLLING OUT LRP,  
HLRS PODS ARE ACCESSIBLE FOR DIRECT SIDE HANDLING



**TWO 6K FORKLIFTS PERFORM ENTIRE UNLOADING OPERATION  
AND LOAD TRAILER WITH THE FOUR PODS IN 5 MINUTES**



**OBSERVERS VIEW EMPTY LAR JUST PRIOR TO BEING ROLLED  
BLCS INTO COMMERCIAL END OPENING CONTAINER**